C187

USER MANUAL

MoTeC

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Introduction

The C187 comes standard as a combined 7" full colour display, powerful control device and fully programmable data logger with 250 MB memory (500 optional). The anti-reflective, high contrast display is clear and vibrant in direct sunlight.

Displayed channels, labels and colours are configurable on a diverse set of supplied layouts; alternatively, use Display Creator software to create fully configurable custom layouts. The C187 acquires data from devices such as an ECU and displays data channels, warning alarms, lap times, fuel calculations, maths functions and much more.

Features

The C187 comes with a range of features as standard and several options available as upgrades to customise and grow your system. These additional features are activated through a simple password acquired from MoTeC, at any time when you need it. See *C187 Upgrades*

General

- All-in-one display, logger and controller eliminates the need for separate devices
- 16 full colour (RGB) LEDs; colour, function and intensity are fully programmable
- Suitable for cars, marine and industrial applications
- Compact, durable and reliable unit
- Supports wideband Lambda from PLMs or LTCs, using Bosch LSU or NTK UEGO 5 wire sensors
- Straightforward control for lights, fans, pumps and PID controlled devices
- Easily integrates with MoTeC CAN based products such as ECUs and expanders. Full I/O expansion available with use of E888, E816, VIM and SVIM expanders.
- GPS Lap Timing
- Tell Tales
-
- Preserved Channels
- Running Min/Max, Timers, PID Control, Engine Log

Logging and Analysis

- Internal data logging, 250 MB standard or 500 MB optional.
- Diagnostic Logging
- Fast download via Ethernet
- Accommodating over 300 channels derived from a mixture of analogue and digital inputs, RS232 and CAN data channels
- Configurable to use sensors from some existing engine management systems
- Data analysis with i2 Standard or optional i2 Pro software
- Telemetry (T2) and remote logging options

Display

- High resolution 178 mm (7") colour anti-reflective LCD display, with high brightness for sunlight readability
- 10 customisable layout options with diverse colour schemes, or purchase the Display Creator software to create fully configurable custom layouts.
- Customisable measurement units and warnings
- Configurable dial, sweep or bar graph can display any channel with optional peak, hold and shift markers
- 48 user-defined alarms, e.g. Low Oil Pressure, Low Fuel, Fast Lap
- Programmable overrides - particularly useful for showing values such as lap times
- Three programmable modes or 'pages' with customisable labels ensure the driver is shown only the most relevant information at any given time
- Adjustable backlight

Software

- Windows-based software designed for setup and management of the display and data logging system
- The user can generate a configuration file offline and then send the completed configuration to the C187
- Calculations including lap times, lap gain/loss, speed and distance, fuel prediction
- Monitor active channels—view all channels live
- Sensor zeroing
- Details editor including event, venue and vehicle details
- Extensive Help screens

- Latest software version is available free of charge from www.motec.com/downloads

Compatibility

- MoTeC ECUs: M4*, M48*, M8*, M400, M600, M800, M880, M1
- MoTeC Accessories: VIM, SVIM, E888, E816, SLM, PLM, LTC, BR2, PDM, GPS, VCS, Telemetry etc.
- Many non-MoTeC devices

*For some ECUs, an additional cable/adaptor may be required.

Required Accessories

Refer to *Connecting the C187 to a PC*

- Standard Ethernet cable
- Any one of the following Ethernet to Autosport connections
  - #62206 C185 loom (used in both the C185 and C187)
  - #61131 Ethernet cable unterminated, 2 meter
  - #61132 Ethernet to Autosport pins cable, 1.8 m

System Overview

The C187 offers extensive possibilities to integrate with ECUs, peripheral devices and accessories to form a complete solution that powers, controls, logs, monitors and communicates virtually any automotive parameter.

The picture shows just one example. For a tailored solution to your application contact your dealer or check out the website.

Typical Devices Used With C187

ECUs

The C187 can be connected to most MoTeC ECUs and some other manufacturers' models either via CAN or RS232. This avoids duplication of sensors and allows the C187 to display and log many ECU parameters.

The typical update rate is about 20 times per second for RS232 and 50 times per second for CAN.

Sensors

The C187 inputs can be connected to a wide variety of sensors. Different types of sensors are available to suit different types of measurements, for example: temperature, pressure, movement etc.

Sensors convert a physical measurement (e.g. pressure) into an electrical signal (e.g. volts).

Different types of sensors generate different types of electrical signals. For example most temperature sensors convert the temperature into a variable resistance which may be measured by an Analogue Temperature input, however most wheel speed sensors generate a variable frequency signal which must be connected to either a Digital input or a Speed input.

Expanders

VIM / SVIM

The VIM is a compact and versatile input expander module with 24 analogue inputs of various types including high speed, high resolution and differential types. The VIM also has two digital inputs with programmable trigger levels.

Several VIMs may be connected to the C187 providing more than 300 sensor inputs. The VIM supports many different types of sensors including unamplified thermocouples and strain gauges.

The Synchronous Versatile Input Module (SVIM) is a compact expander that works the C187 to facilitate the synchronised logging of high speed, high resolution inputs. Multiple SVIMs are synchronised so that every SVIM in the vehicle samples its high resolution AV inputs at the same instant in time.

SVIMs are versatile in nature and can be located close to sensors, reducing the weight and complexity of wiring. When used in multiples, up to 200 sensor inputs are available. The SVIM supports many different types of sensors, including unamplified thermocouples and strain gauges.

E888/E816

The C187 supports two E888 or E816 Expanders allowing expansion of the number of inputs and outputs.

The E888 has 8 x 10 bit thermocouple inputs, 8 x 10 bit voltage inputs, 4 digital inputs, 2 switch inputs and 8 outputs.

The E816 has 16 x 10 bit voltage inputs, 4 digital inputs, 2 switch inputs and 8 outputs.

Note: The E888 / E816 inputs have lower resolution than the VIM/SVIM inputs and have slower update rates.

Accessories

BR2

A BR2 Beacon Receiver may be connected to the C187, which allows the C187 to calculate lap times for display and to provide lap information for the data logging analysis software.

SLM

The SLM Shift Light Module can be used for shift lights, warnings and other driver alerts.

It comprises 8 LEDs that can be programmed to display any colour.

GPS

The C187 supports many GPS (Global Positioning System) devices allowing the C187 to record speed, generate lap times and measure position information.

This information can be used in the ***i2*** data analysis software to create track maps, and plot and compare driven lines.

Telemetry

The C187 supports transmission of data via a telemetry radio to a remote location such as a pit garage. This allows monitoring of the current vehicle condition, position on the track, lap times, fuel remaining, laps remaining etc.

The telemetry system provides three major functions:

1. Real time data that is transmitted continuously and can be shown on graphs, gauges and other displays.

2. End of lap data which shows summary information at the end of a lap such as lap time, maximum temperatures etc.

3. Telemetry analysis which exports the real time data to the ***i2*** analysis software at the end of each lap or on demand which allows normal

analysis of the data including maths calculations, while the vehicle is still on the track.

Other telemetry features include: warning alarms, position of multiple vehicles on a track map, broadcast data via DDE (Dynamic Data Exchange) or via IP (Internet Protocol).

Note: The Telemetry option is required for the basic functionality. The Remote Logging option is required in addition to the Telemetry option for the Telemetry Analysis function.

High Definition Video

MoTeC brings true high definition to motorsport with its new HD Video Capture System. The HD-VCS provides superior quality video and numerous features designed specifically for the racing environment.

Features include:

- Genuine High Definition with 1080p @ 30 frames per second
- Automatic Start/Stop, eliminating the possibility of drivers forgetting to turn it on
- 12 V power direct from the vehicle - no batteries to recharge
- Live gauges automatically recorded on the video
- Over 5 hours of recording at 1080p
- Records to removable storage up to 32 GB
- Video can be played directly from the card
- Automatic CAN Synchronisation with data in i2 (available late 2013)
- Compact, lightweight recording unit

Lambda Measurement

PLM

The PLM Professional Lambda Meter measures the air fuel ratio over a wide range of mixtures with fast response time. It is compatible with Bosch LSU and NTK UEGO Lambda sensors and displays the Lambda readings via the integrated display.

LTC/LTCD

The LTC Lambda to CAN modules provide accurate Lambda measurements even when the exhaust gas temperature changes rapidly. They are compatible with the Bosch LSU 4.9 Lambda sensor and transmit Lambda readings via the CAN bus.

Remote Displays

A remote display device may be connected to the C187 to allow display of any value that the C187 calculates, such as lap times and warning alarm messages.

The C187 supports D153, D175 displays which are connected via CAN.

PDMs

Power Distribution Modules are designed to replace conventional relays, fuses and circuit breakers by providing electronically switched power to the various electrical systems in the vehicle. This simplifies wiring and switch requirements, while increasing reliability.

Full diagnostic information, including output currents and error status can be transmitted via CAN to the C187.

Several models are available to suit vehicles with different complexity ranging from 15 to 32 outputs and 12 to 23 inputs.

Other Devices

Many other devices can be connected to the C187. Contact your dealer for advice.

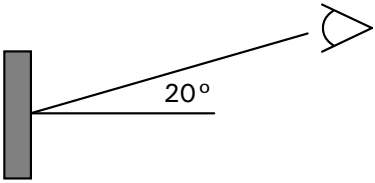
Installation

Mounting and Wiring

C187 has three threaded mounting posts. For further detail see *Mounting Dimensions*.

Mounting Tips

- Avoid twisting the case: use washers between the unit and the mounting panel to ensure that the unit is mounted only at the mounting points and do not over tighten the mounting screws.
- Vibration isolation may be desirable if the vehicle vibrates severely.
- Mount so that the connector may be easily accessed.
- Orientation: for best contrast, the display should be viewed at an angle of approximately 20 degrees, However the C187 will give good contrast between 0 and 40 degrees. Display reflections should also be considered when determining the mounting angle.



The C187 uses a 79 pin Autosport connector. See *Connector* and *Pin List by Pin Number* for full details.

Wiring Tips

- To ensure that the connector is sealed, plug unused holes with filler plugs. A heat shrink boot may also be used if desired.
- Use 22# Tefzel wire (Mil Spec M22759/16-22) (5 A max at 100 °C)
- Tefzel wire is difficult to strip unless the correct stripping tool is used.
- Be careful not to nick the wires as this may result in wire failure or poor crimping.
- Some sensor connectors may not be available with 22# terminals, in which case doubling the wire over gives the equivalent of an 18# wire. This is suitable for many of the common sensor terminals.

- Use the correct crimping tool for all contacts to ensure a reliable connection.
- Power the C187 via a separate switch and a 5 ampere fuse, to ensure the PC can communicate with the C187 without the need to power the rest of the vehicle.
- The C187 ground must have a direct connection to the vehicle battery.
- C187 is connected to other devices via the CAN bus. Refer to *CAN Bus Wiring Requirements* for details.

Connecting Devices

Inputs

Input Types

A range of sensors is available to suit different types of measurement, e.g. temperatures, pressures, speed. Each type of measurement generates a different electrical signal that requires a suitable input type.

Each sensor needs to be connected to the type of input designed to suit that type of sensor.

MoTeC devices have the following input types available:

- Analogue Voltage Inputs
- Analogue Temperature Inputs
- Switch Inputs
- Digital Inputs
- Wheel Speed Inputs

Note: Some inputs require a device upgrade to make them available

In addition to sensors connected to the inputs, the C187 has internal sensors available for battery voltage, 3-axis G force and device temperature.

Analogue Voltage Inputs

Analogue Voltage inputs are normally used to measure the signals from analogue voltage type sensors, i.e. sensors with variable voltage outputs, such as:

- Rotary or linear potentiometers
- Signal conditioned 3 wire pressure sensors
- Thermocouple amplifiers
- Accelerometers

These inputs can also be used to measure two wire variable resistance sensors if an external pull-up resistor is connected from the input to the 5 V sensor supply.

Additionally, on/off switch signals may be connected, which may also require an external pull-up resistor.

Analogue Temp Inputs

Analogue Temperature inputs are identical to Analogue Voltage inputs, except that they contain a 1000 ohm resistor which is connected internally from the input pin to the 5 V sensor supply. This allows the Analogue Temperature inputs to be used with two wire variable resistance sensors such as:

- Two wire thermistor temperature sensors
- Two wire variable resistance pressure sensors

Some voltage output sensors can also be used if they can drive the 1000 ohm resistor without causing an error in their reading (e.g. MoTeC Thermocouple Amplifier).

Additionally, on/off switch signals may be connected.

Switch Inputs

Switch inputs are generally used for the external switches required to operate the display. These inputs have a 4700 ohm resistor connected internally from the input pin to the 5 V sensor supply so that a switch can be simply connected between the input pin and 0 V.

They can also be connected to a brake switch or other switch.

Digital Inputs

Digital Inputs are identical to Switch Inputs except that they include the following additional measurement methods:

- Frequency: The frequency of the input signal is measured
- Period: The time between successive pulses is measured
- Pulse width: The low time of the pulse is measured
- Count: Counts the number of pulses
- Beacon: For connection of a lap beacon

Speed Inputs

Speed Inputs are identical to Digital Inputs except that they can also be configured to suit Variable Reluctance (Magnetic) sensors e.g. some wheel speed sensors. Because the amplitude of the signal from these

sensors varies with speed of rotation, variable trigger levels are required, which must vary with the frequency of the input signal.

The Speed Inputs can also be used with Hall Effect type wheel speed sensors.

The Pulse Width measurement method measures the high time of the pulse rather than the low time as measured by the Digital Inputs.

Input Specifications

For full specifications refer to *Input Characteristics*.

Expanders

If additional sensors are required, input expanders can be used e.g. E888, E816, VIM, SVIM. Sensors can be connected to the expander inputs and communicate via either RS232 or CAN. See *Configuring Communications*.

Outputs

Auxiliary Outputs are used to control various vehicle functions e.g.

- Gear Change Lights
- Warning Lights
- Thermatic Fan
- Gear Box Oil Pump

Note: Devices that consume more than the maximum current (e.g. motors) should be driven via a relay or PDM.

Output Specifications

Full specifications can be found in *Output Characteristics*.

Expanders

If additional outputs are required, output expanders can be used e.g.E888, PDM. Expander outputs can perform the same tasks as the device outputs and can be driven by communication via either RS232 or CAN. See *Configuring Communications*.

Communications

Communications are used to send and receive data from one device to another. There are two communication protocols; RS232 and CAN. Generally older devices use RS232 and newer devices use CAN.

CAN (Controller Area Network) Communications

This protocol enables communication between all devices connected to the same bus. The CAN bus allows communicating at high speeds. The C187 has two independent CAN communications ports that can be connected to other devices with a compatible CAN port. The bus speed for each interface can be set independently.

Typical devices communicating over CAN:

- 'Hundred series' ECU: M400, M600, M800, M880
- Shift Light Module: SLM
- Lambda meters: LTC, PLM
- Expanders and input modules: E888/E816, VIM
- Displays: SDL
- Beacon receiver: BR2

These devices communicate at 1 Mbit/sec, so any other devices connected on the CAN bus must also communicate at 1 Mbit/sec. If a device communicates at another speed, it should be wired to the other CAN bus, and the speed of that CAN bus must be set to match the speed of the device.

RS232 Serial Communications

This is a one to one protocol, communicating from one device to one other device. Typical devices communicating over RS232:

- M4, M48 ECUs
- Radio telemetry device
- Global positioning system: GPS

Note: The C187 can communicate with devices for which it has the appropriate communications protocol defined. For other devices, users can define their own custom communication settings.

Connecting Devices Examples

Device	Connect via	Remarks
Sensors	**Inputs:** The appropriate input type depends on the sensor type	MoTeC supplies datasheets with wiring details for all sensors via the website
External Buttons for: - Display mode - Display next line (and optional previous line) - Alarm acknowledge - Lap number reset - etc.	**Inputs:** Switch input Alternatively Digital or Analogue Voltage inputs can be used	Wire between Display Logger input and Display Logger 0 V. If wired to an Analogue Voltage input connect an external pull-up resistor between the input pin and the 5 V sensor supply.
External LED Lights	**Outputs:** Auxiliary output	Wire between one of the Auxiliary Outputs and battery positive and include a current limiting resistor
SLM Shift Light Module	**Communications:** CAN	
K-type Thermocouples	**Inputs:** Analogue Voltage or Analogue Temperature input **Communications:** CAN	Connect via TCA Connect via E888 or VIM/SVIM
ECU M4, M48, M8	**Communications:** RS232	Uses the Telemetry feature of the ECU to send data to the Display Logger
ECU 'hundred series': (M400, M600, M800, M880), M1	**Communications:** CAN	Ensure the ECU and Display Logger are connected on the same CAN bus
Telemetry	**Communications:** RS232	Wiring is dependent on the particular telemetry system; refer to the wiring details supplied with the telemetry system

Software Installation

C187 Dash Manager Software

C187 Dash Manager software is used for configuration, testing, retrieving the logged data, and for general management of the C187.

C187 Dash Manager supports configuration of the following connected devices: VIM, SVIM, E888/E816, SLM.

PC Requirements

C187 Dash Manager runs under Windows XP or Vista operating systems. The minimum recommended PC specification is a Pentium 90 with 16MB RAM and an Ethernet port

Installing C187 Dash Manager Software

- Go to the MoTeC website at www.motec.com and navigate to software/latestreleases/C187 Dash Manager software
  OR Locate C187 Dash Manager software on the MoTeC Resource Disc
- Save the selected file in your preferred location (for example desktop)
- When downloading is finished, double click on the file and select run
- Follow the instructions on the InstallShield Wizard
- To start the program after installation, click the C187 Manager icon on the desktop or click **Start > All Programs > MoTeC > C187 > C187 Dash Manager**

Updating C187 Dash Manager Software

- Software updates are available to give access to the latest features. Download the latest software version from the website and follow the software installation instructions to update to the new version.
- To update the associated firmware in the device select *Upgrade Dash Version* from the *Online* menu. See Configuration Versions and Updating.

i2 Data Analysis Software

i2 data analysis software is used to analyse the logged data that has been recorded by the C187. Any number and combination of graphs, gauges and reports can be analysed simultaneously. The ***i2*** environment can be customised to specific user requirements.

There are two levels of analysis functionality available; ***i2 Pro*** and ***i2 Standard***.

i2 Standard is included, while ***i2 Pro*** requires the optional Pro Analysis upgrade. See *C187 Upgrades*.

i2 Pro provides advanced mathematics, multiple overlay laps, and unlimited components, workbooks and worksheets.

Telemetry Monitor Software

The Telemetry Monitor software is used to monitor the optional telemetry link and allows viewing of live data in various graphical formats such as charts, bar graphs and dial gauges. It can also show the vehicle's current track position on a track map and compare the current vehicle data to reference data.

Telemetry Monitor software requires the optional Telemetry upgrade. See *C187 Upgrades*.

Connecting the C187 to a PC

The C187 connects to the Ethernet port on the PC. This requires a connector for the standard Ethernet cable in the loom.

The loom #61213 incorporates this connector. Alternatively the connector can be wired into an existing loom using the unterminated Ethernet cable (#61131) or the Ethernet to Autosport pins cable (#61132).

All options are used in conjunction with a standard Ethernet cable.

Connection details are described in

Wiring.

PC Communications Setup

To enable PC communications a connection must be setup in the C187 Dash Manager to match the C187 serial number.

- On the *Tools* menu click *Connection Settings* and then click *Add*
- Click *OK* to choose *IP (Ethernet).* This is the only available connection type
- Enter the C187 serial number

If the PC needs to communicate with more than one C187, repeat the steps.

Only one connection can be active at a time. To switch to a different C187 select the appropriate connection and click *Make Active*.

Network Connection

Optionally, the C187 can be connected to a network. This allows for any PC on the network to communicate with the C187.

For more information on IP addresses see *PC Connection - IP Address*.

Configuration

All aspects of the C187 can be configured including, which sensor is connected to which input, the calibration of each sensor, what to display and where to display it, what to log and how fast to log it, tacho range, warning alarms, multi stage shift lights, etc.

The configuration is stored in a configuration file on the PC. When starting C187 Dash Manager the menu items related to changing the configuration are unavailable. To make them available, load a configuration file either by opening an existing file or by creating a new one.

All changes to the C187 configuration are performed 'Offline', i.e. without the PC communicating with the C187. The changes are saved in the configuration file on the PC. The file must be sent to the C187 before the changes take effect. See *Operation*.

Tip: When using a laptop in and around a car, it is often not practical to use a mouse to navigate through the program. Using the keyboard to select options is easier. An overview is given in *Windows Keyboard Shortcuts*.

Configuration File

From the *File* menu the following option are available:

- *New* creates a new configuration based on a predefined template.
- *Open* selects an existing file.
  Right-click the configuration file to Rename, Delete, Send to a disk etc.
- *Save* after a new configuration has been defined, it should be saved with a meaningful name.
- *Save as* can be used to create a copy of an existing configuration file by giving it a new name.
- *Edit Details* allows for entering event, venue and vehicle details to be stored with the configuration file.
- Check Channels verifies that all channels are correctly generated.
- *Edit Configuration Comments* allows for other comments to be stored with the configuration file.
- *View Configuration Summary* gives a quick overview of the configuration file.
- *Convert Logging Image* allows users to manually convert a log file for use in ***i2.***
- *Exit* exits the program.

Tip: The most recently used files appear at the bottom of the *File* menu. This is often the easiest way to open an existing file.

Backups

Whenever a file is saved, the previous content of the file is saved in the *Save Backups* directory. The total number of files is limited to 100.

Channels

Channels are used to convey information between the various systems of the C187. For example an input pin may feed a channel called ‘Fuel Pressure’. This channel may then be used by another system, such as the Display System or Data Logging systems.

The C187 channel scheme allows complete flexibility in channel usage, as any available channel can be used by any other function, i.e. any channel can be logged, displayed, used in conditions, used in alarms, used as an input to the user definable tables, etc.

All systems within the C187 that generate values must feed one of the channels.

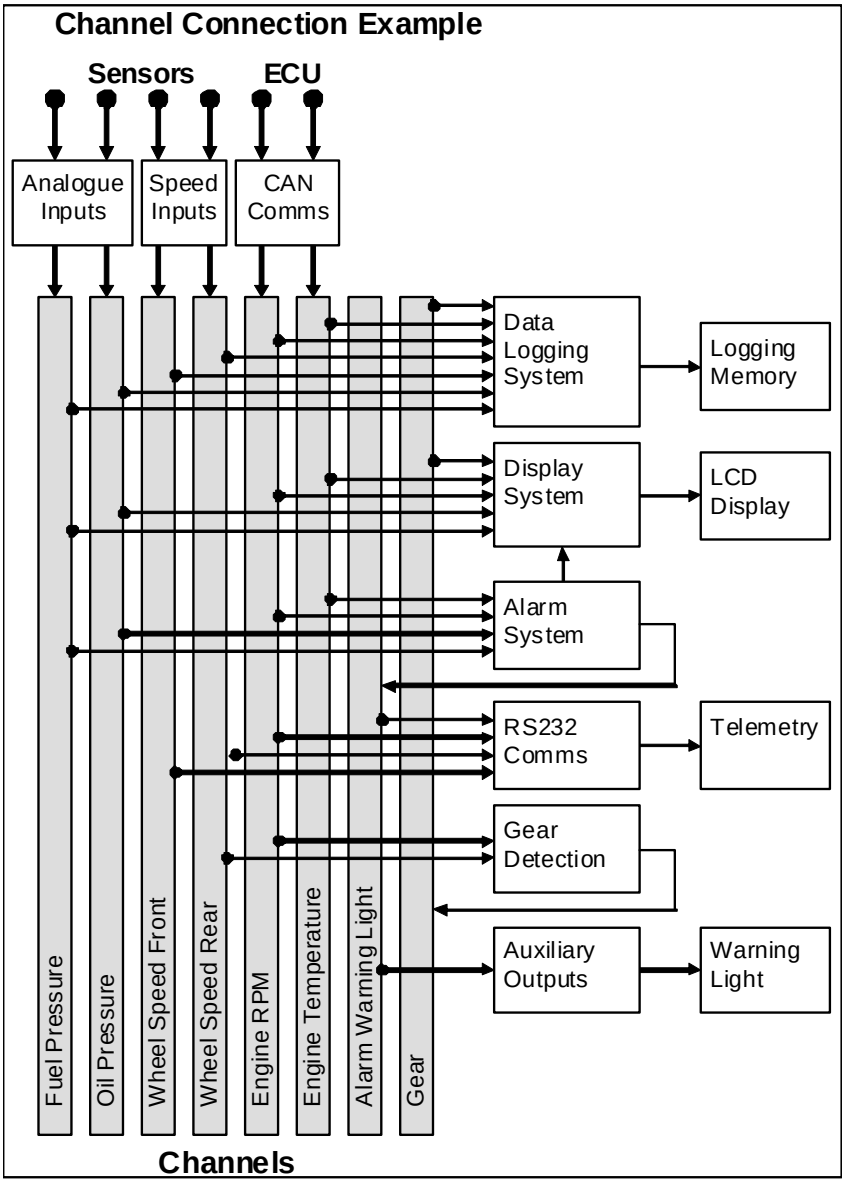
Pre-defined Channels

MoTeC has defined an extensive list of channels.

General Purpose Channels

Since the use of all channels cannot be predetermined, a number of general purpose channels have been included for occasions when a suitable predefined channel is not available.

These general purpose channels may be required when measuring an uncommon value, or when a general purpose function needs to generate a special output channel. For example, a 3D table may generate an output channel to control a valve of some sort, in which case a general purpose channel may be used and named appropriately.


Channel Connection Example
Sensors
ECU
Analogue Inputs
Speed Inputs
CAN Comms
Data Logging System
Logging Memory
Display System
LCD Display
Alarm System
RS232 Comms
Telemetry
Gear Detection
Auxiliary Outputs
Warning Light
Fuel Pressure
Oil Pressure
Wheel Speed Front
Wheel Speed Rear
Engine RPM
Engine Temperature
Alarm Warning Light
Gear
Channels

Channel Properties

Each channel has defined properties, some of which may be modified by the user. Predefining these properties makes the channels easy to use throughout the rest of the software.

- Properties that may be modified by the user
  - Name
    The channel names (and abbreviations) may be changed if necessary. However name changes should be limited to name preferences rather than redefining the purpose of the channel, except for the general purpose channels which may be renamed to suit the current use.
  - Abbreviation
  - Units (e.g. degrees Celsius, degrees Fahrenheit)
    The units for a channel can be selected from a predefined list, for example the Engine Temperature channel may have units of degrees Celsius, Fahrenheit or Kelvin. Conversion between units is automatically handled by the software.
    Note: The units are used for display purposes only. This means that the units can be changed at any time without affecting the calibration of the channel.
- Fixed properties
  - Measurement type (e.g. Temperature)
    Defining the measurement type allows the channels to be displayed in any unit suitable for that type, with automatic conversion between the units. For example all temperature channels can be displayed in degrees Celsius, Fahrenheit or Kelvin.
  - Resolution
    The resolution of all channels is fixed, for example the resolution of the Engine Temperature channel is fixed at 0.1 °C.
    Fixed channel resolutions ensure that the unit conversion system works properly and that channel comparisons can be performed correctly.
  - Suitable logging rates
  - Suitable display filtering
  - Minimum and maximum range

Selecting Channels

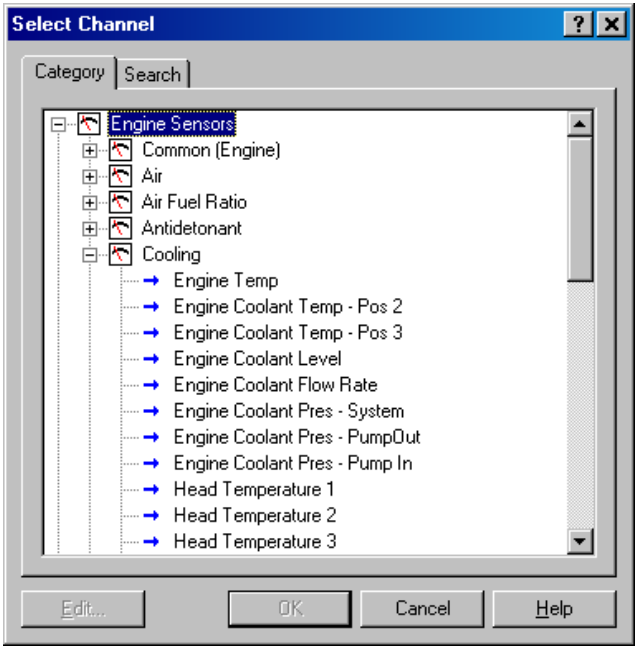
There are two methods of selecting channels, either the Category Method or the Search Method.

Category Method

This method divides all the channels into categories and sub categories, so that the list can be narrowed down to a small list of channels. For example, the 'Engine Sensors / Cooling' category shows a list of channels associated with the cooling system of the engine.

When selecting a channel from the complete list of channels, it is usually easiest to use the category selection method, for example when assigning a channel to an input pin.

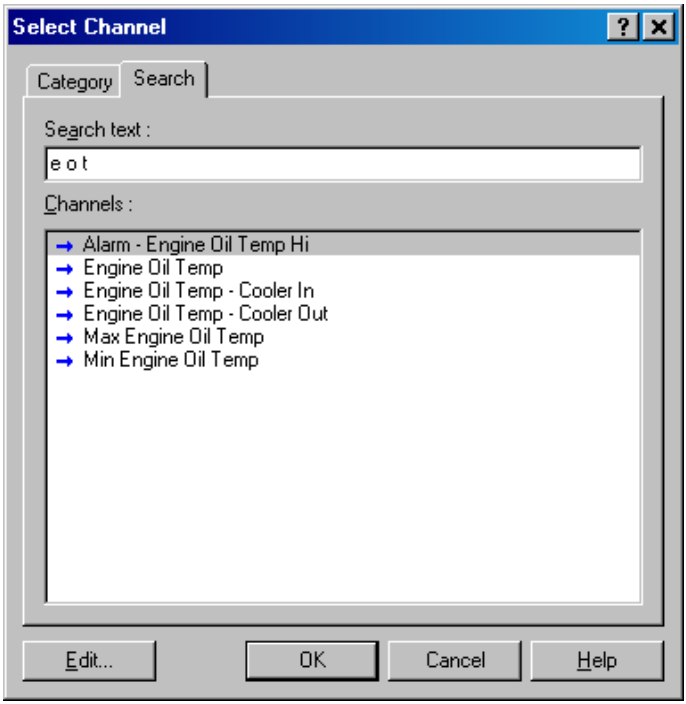
Tip: To expand a category click on the plus sign (+) next to the category name.



Search Method

This method lists all channels in alphabetical order and allows a channel to be found either by typing the first few letters of any word in the channel name, or by scrolling through the list.

Note: The words may be typed out of order so that ‘Engine Oil Temp’ could be found by typing "temp eng oil" or "oil t eng" or "e o t”



This method is most useful when selecting a channel from the available channels. For example, if ‘Engine Temperature’ has been assigned to an input pin, it can be easily located in the Search list, since this list normally only contains 50 to 100 items.

Connections

Configuring Inputs

- On the *Connections menu*, click *Devices*
- Select the device (e.g. C187) and then click the *Input pins* tab

  This will list all inputs available for this product

  Note: Some inputs require the 44 I/O Upgrade to make them available. See *C187 Upgrades*
- Select the input and click C*hannel* (or double click the input)
- Assign a measurement channel to the input and click *OK*

The channel needs to be calibrated using one of two options

- Select *Load Cal* if a pre-defined calibration is available
  OR
- Double-click the input to enter a calibration

Other tasks:

- *Change Cal* – to change the calibration
- *Spd Levels* – only for speed inputs
- *Settings* – to set default

Configuring Outputs

- On the *Connections menu*, click *Devices*
- Select device (e.g. C187) and then click the *Output Pins* tab to list all outputs available for this product

  Note: Some outputs require 44 I/O Upgrade to make them available. See *C187 Upgrades*.
- Select the output and click C*hange* (or doubleclick the output)
- Select a mode to make appropriate settings available
- Follow the directions on the screen and when all settings are done click *OK*

Configuring Communications

- On the *Connections menu*, click *Communications*
- Select an available communications section (CAN or RS232)
- Click *Select* and choose one of the available communications templates

Comms Templates

Communication templates are available for most connected MoTeC devices. When MoTeC releases new products, new communication templates will also be released. These will be incorporated in the latest software versions. See *Updating C187 Dash Manager Software* on how to update to a new software version to make the latest communication templates available.

Calculations

The C187 has special and user definable general purpose calculations available. They are set up from the *Calculations* menu.

Special Calculations

- *Lap Time and Number* click on the tabs to set up Lap Time, Lap Speed, Running Lap Time, Split Lap Times, Lap Number, Laps Remaining
- *Speed and Distance* click on the tabs to set up Ground Speed, Drive Speed, Wheel Slip, Lap Distance, Trip Distance, Odometer
- *Lap Gain / Loss* to set up a continuous indication how far behind or ahead the vehicle is compared to a reference lap
- *Gear Detection* to set up Current Gear
- *Fuel Prediction* click on the tabs to set up Fuel Used, Fuel Usage, Fuel Remaining, Laps Remaining, Fuel Used per Lap
- *Running Min / Max* to set up Minimum Corner Speed, Maximum Straight Speed and other Min/Max values

General Purpose Calculations

- *Tables* to set up 2D and 3D Lookup Tables
- *Timers* to set up General Purpose Timers
- *User Conditions* to activate items such as a Thermatic Fan or Gearbox Oil Pump
- *Channel Maths* to perform basic calculations on channels
- *Advanced Maths* to perform advanced calculations
- *Bit Combine* to set up a bit mask
- *PID Control* to set up the proportional, integral and derivative gain control
- *Counters* set up to 10 counters. Counter value can be increment or decremented based on the selected channel conditions

For details refer to C187 Dash Manager online help.

Functions

Data Logging

Data logging allows sensor readings and calculated values to be stored in the C187 memory for later analysis using the ***i2*** Data Analysis software.

To configure logging

- On the *Functions* menu, click *Logging*
- Select the relevant tabs to set up the logging parameters

Refer to C187 Dash Manager online help for additional information.

Power

The C187 power can be turned off at any time without losing the logged data, because it uses FLASH memory that does not require an internal battery to keep it alive.

Logging Memory

The C187 comes with 250 MB memory as standard. The Data Logging upgrade will increase this to 500 MB. See *C187 Upgrades*.

Start and Stop Logging Conditions

To avoid logging unnecessary data, logging can be started and stopped by user definable conditions.

For example logging might start when the vehicle exceeds 50 km/h, and stop when the engine RPM is below 500 RPM for 10 seconds.

C187 provides the normal logging type; this will continuously log data to memory whenever the Start Condition is true and the Stop Condition is false.

Memory Usage

When the logging memory is full the C187 may be configured to either stop logging, or to overwrite the oldest data, which ensures that the most recent data is always available. This is referred to as cyclic logging.

For most applications it is recommended that cyclic logging is used.

Logging Time

The maximum logging time is dependent on the logging memory size, the number of items logged and the rate at which they are logged. The configuration software will report the total available logging time.

Logging Setup Files

The logging list can be saved and loaded from a file. This allows multiple logging setups to be used.

Logging Rate

The logging rate sets how often each channel is logged and can be set individually for each channel. The C187 can store values at up to 1000 times per second.

The rate at which the values are logged must be fast enough to record all variations in the reading. If the value is logged too slowly, the readings can be totally meaningless. For example, suspension position may need to be logged at 200 times per second or more.

However, if a value is logged faster than necessary it will not improve the accuracy of the logged data. It will just reduce the total logging time available. For example, the engine temperature only needs to be logged at once per second.

CAN Bus Bandwidth Limit

High logging rates also increase the amount of data that is being received from the measurement devices, which increases the amount of data on the CAN bus. This can lead to exceeding the CAN bus bandwidth limit. See *CAN Bus Bandwidth Limit*.

Note: The C187 Manager will warn if the bandwidth is likely to be exceeded.

Maximum Logging Rate

The maximum logging rate is limited to the update rate of the particular channel. This varies significantly depending on the source of the channel. For example, some VIM inputs update at 5000 Hz, whereas some communications devices may only update at 50 Hz. Also some internal calculations may be limited to 100 Hz.

Update Rate

Each input is measured at a maximum rate which is dependent on the capabilities of the measuring device and may also vary between inputs on that device. For example the VIM has some inputs that update at 500 Hz and others that update as fast as 5000 Hz. See *Update Rate Summary*.

Anti-Alias Filter

If a channel is logged at a rate slower than its specified update rate then an optional anti-alias filter can be applied.

The anti-alias filter is used to average out any variations in the signal between logged values. This ensures that unrepresentative values are not logged.

The anti-alias filter is implemented by averaging the channel values between logging events. For example, if a channel has an update rate of 1000 Hz and it is logged at 100 Hz then the preceding 10 samples will be averaged each time it is logged.

The anti-alias filter is normally turned on by default when a channel is added to the logging list, but may be turned off if required. For normal purposes it is recommended that the anti-alias filter is left turned on.

Note: For some channels the anti-alias filter cannot be turned on because the averaging performed by the filter would cause incorrect values. This is the case for on/off channels and channels where the bit values have a particular meaning, for example error group channels.

Real Time Value (VIM/SVIM, ADL2, SDL)

For channels that come from a VIM, SVIM an ADL2 or an SDL the logging anti-alias filter also affects the real-time value of the channel. This is the value that all other parts of the system see, such as the various calculations.

Note: The anti-alias filter is limited to 50 Hz for real time values even if the channel is logged at a lower rate. For example, a channel logged at 10 Hz will be filtered and updated at 10 Hz in the logging and 50 Hz for the real time value.

Note: Channels that are not logged are updated at 50 Hz.

Real Time Value (For devices other than VIM, SVIM, ADL2, SDL)

The real time value from other devices and from internal calculations is not anti-aliased at the logging rate, however the value can be anti-aliased in the logging.

Phase Shift

The anti-alias filter will cause a phase shift (time delay) of half the logging rate. For example, a channel logged at 100 Hz is logged every 10 milliseconds, so it is delayed by 5 milliseconds.

For most purposes this time delay is not an issue.

Channels logged at the same rate are delayed by the same amount, which negates this effect when comparing these channels.

This applies to all channels whether they are generated internally from a calculation or whether they are generated externally from devices such as a VIM or a display device.

Track Map Sensor Requirements

In order for the ***i2*** Data Analysis software to plot a track map the following sensors are required and must be logged.

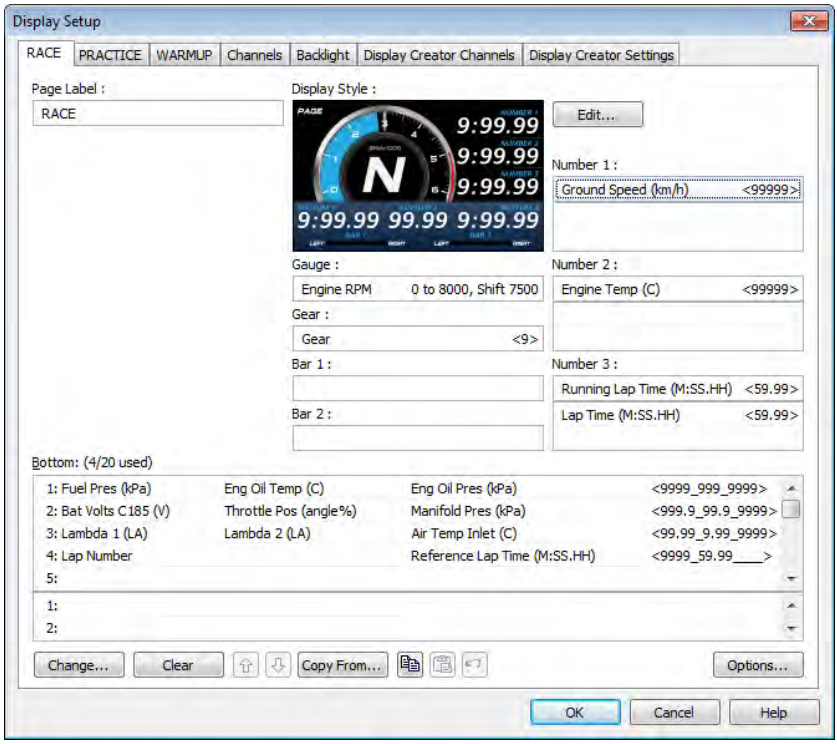
- Lateral G force (internal sensor)
- Wheel Speed
- Lap Beacon (the 'Beacon' Channel must be logged)
- Optionally Longitudinal G force (internal sensor)
  A Longitudinal G force sensor should be used if the vehicle has only one wheel speed sensor. This allows the analysis software to eliminate wheel lockups which is essential when creating or using a track map.

Display Using Fixed Layouts

The C187 display is a high contrast, high brightness colour LCD display.

To configure fixed displays

1. On the **Functions** menu, click **Display**.
2. Select the relevant Display type
3. Select the required mode (RACE, PRACTICE, WARMUP) by selecting the relevant tab.
4. Select the required fixed display style by double-clicking on the fixed display style displayed down the left side of the Edit Display Style screen. On the right-hand side are controls to set the colour scheme of the selected style.
5. Set the labels and channels you want to display for each of the numeric display components (e.g. Number 1, Number 2, Gauge, Bar 1 etc.). To do this:
    a. Select the display component.
    b. Select the **Change** button (alternatively, double click on the relevant display component).



Display Modes (Pages)

The display has three display modes or pages; the default names are RACE, PRACTICE and WARMUP. The mode is changed by pressing the button assigned to this function.

The mode names can be changed to suit your individual needs; this is done by double-clicking on the **Page Label** field.

RACE Page

The Race display is normally used to display minimal information, e.g. RPM, Lap Time, Fuel Remaining or Laps Remaining.

PRACTICE Page

The Practice display is normally used to display basic information, plus information to help the driver improve lap times, e.g. Lap Time, Lap Gain/Loss, Maximum Straight Speed, Minimum Corner Speed or Corner Exit Speed.

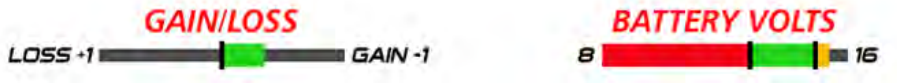
WARMUP Page

The Warm-up display is normally used to display important engine sensor readings during engine warm-up, e.g. RPM, Battery Voltage, Engine Temperature, Oil Pressure, Oil Temperature and Fuel Pressure.

Bar 1 and Bar 2

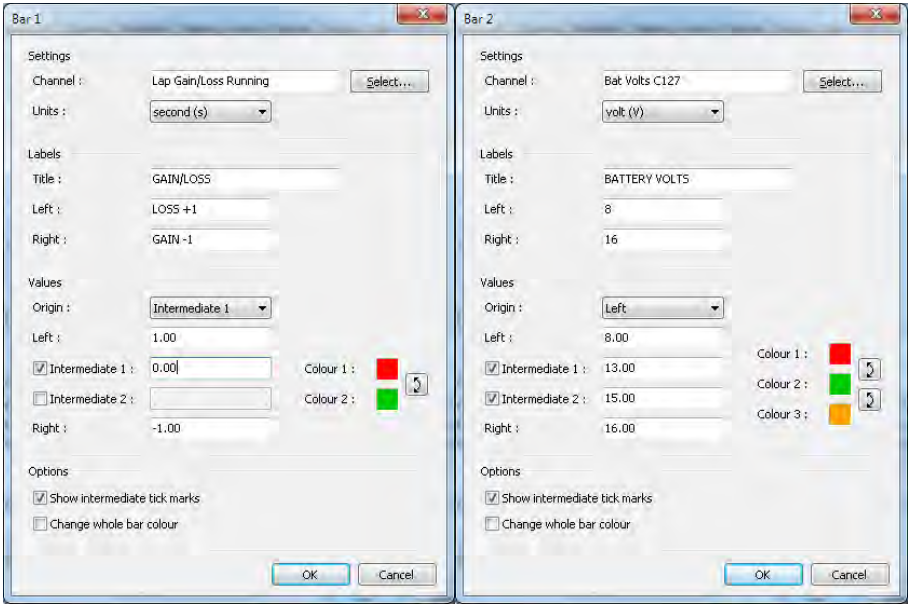
The Bar 1 and Bar 2 facility provides the means to configure two bar type graphs. One could most likely be configured to graphically represent the current value of the Lap Gain/Loss Running channel as a Gain / Loss bar, the other can be configured as any other useful indicator such as a battery voltage, fuel, temperature or pressure gauge.

Two intermediate points can be set, see the battery voltage example below. However, a gain/loss bar can only use the first intermediate point.



Example Bar 1 (gain / loss bar) and Bar 2 (battery voltage gauge)

These bars can be customised to suit a user's preference. The properties for these two examples are shown below.



In the battery volts example, with the Change whole bar colour option not selected, the three specific colours will display in the relative section of the bar according to the channel value, as shown in the example.

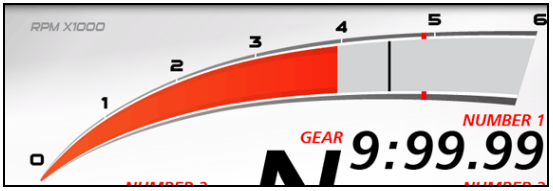
If the Change whole bar colour option is selected, the **whole** bar colour will be red if the channel value is from 8 to 13, green from 13 to 15 and red from 15 to 16.

The bars can be customised to suit a user's preference. For example:

- Setting the scale and the time units.
- Customise the labels at either end of the bar. In the GAIN/LOSS example above, LOSS +1 and GAIN -1 are used, where 1 is the scaling value. Another label example could be LEFT and RIGHT.
- Invert colours.
- Specify the negative to the left or right.

Dial or Bar Graph (depending on style chosen)

Example dial



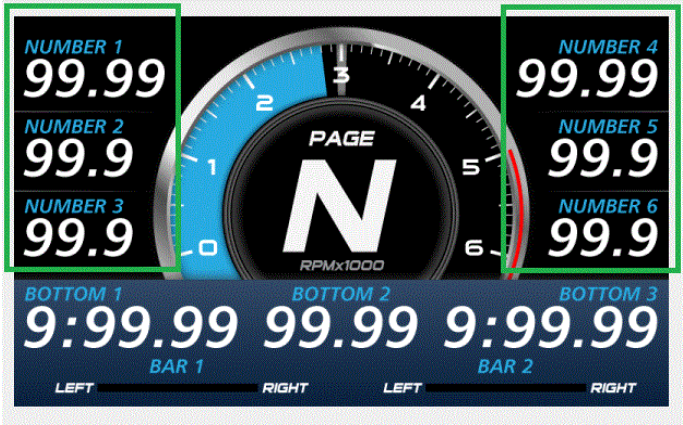
Example sweep bar

Example linear bar

The dial or bar graph has a user definable range and is typically used as a tacho, however it can be used to display any other value.

A fully programmable shift point can be displayed, which can also be gear dependent.

Top Displays

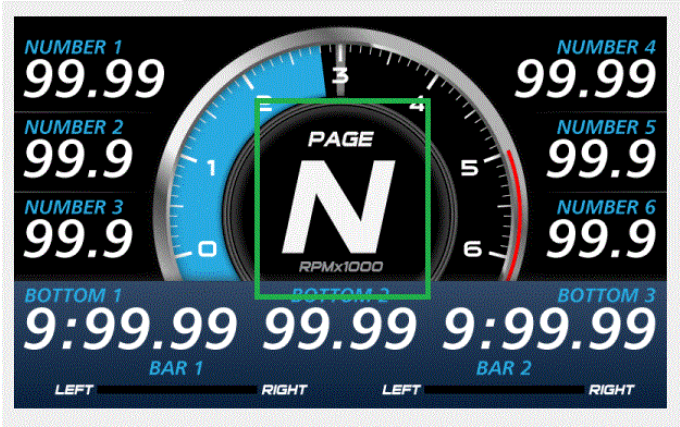


The numeric displays can be programmed to display any channel value.

The numeric displays can show any channel value plus up to two override values. Override values display each time their value is updated. This is useful for values that are updated periodically. The override values are shown for a programmable period of time. For example, a numeric display could normally show the Running Lap Time (which is continuously updating), then be overwritten by the Lap Time for 10 seconds each time the Lap Time is updated.

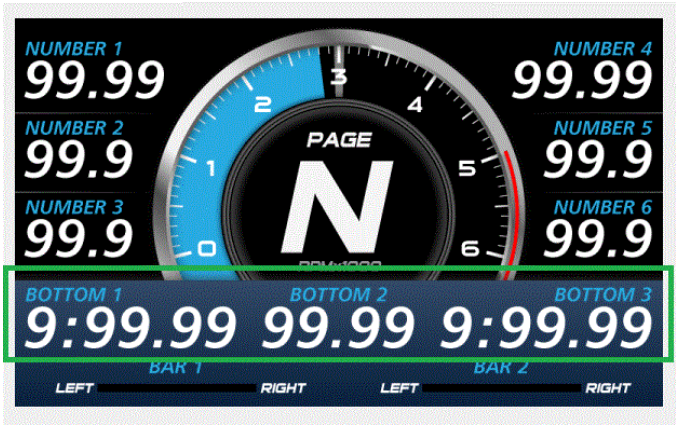
The label above each of the numeric displays can be changed to suit the channel assigned.

Centre Display



The centre display is normally used to display the current gear but can be used for other purposes.

Bottom Display



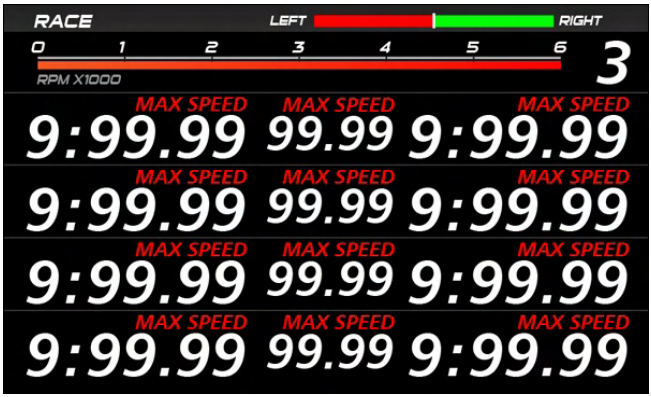
At the bottom, up to 20 lines can be accommodated, with each line containing up to 3 channel values at a time.

The label above each value can be changed to suit the channel assigned.

The 20 lines can be scrolled up or down using external buttons.

Similar to the top numeric displays, the bottom display can show up to four override values.

Four Line Style



Where the four-line style is chosen, it shows four lines of values at a time, with up to three values per line.

The 20 lines can be scrolled up or down, 4 lines at a time, using external buttons.

Alarm Displays

When an alarm is activated, a message is shown along the bottom of the display until it is acknowledged. To draw the driver's attention to the display, it is recommended to activate a warning light.

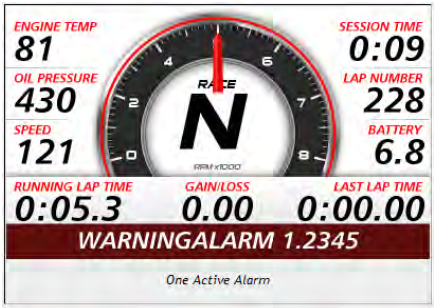
The message can be defined as required and can include the current sensor reading or the sensor reading when the alarm was triggered.

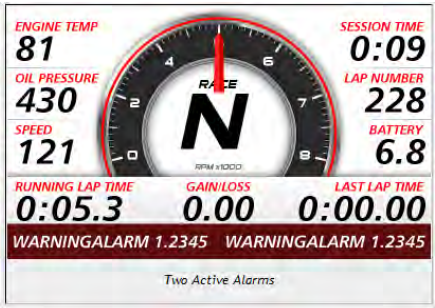
Example active unacknowledged alarm

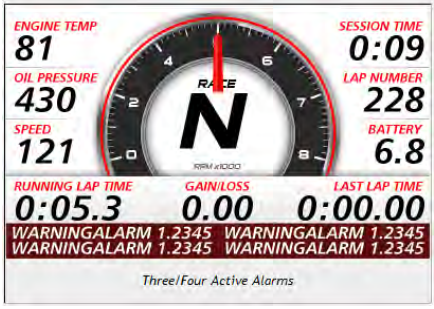
See the Alarms section for details on behaviour and operation of alarms.

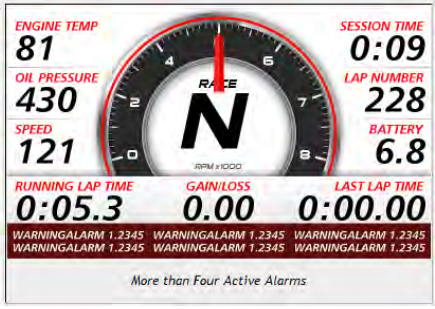
Up to 6 active acknowledged alarms can be displayed in the Alarm Status Panel along the bottom of the display, covering what was there before. By default, the Alarm Status Panel display is OFF. This can be set ON by the user. See Alarms for details about the Alarm Status Panel and its operation.

Below are examples of how active acknowledged alarms would be arranged.









Display Formatting

Units

All display units can be changed to suit the driver preferences, for example, show temperatures in Fahrenheit rather than in Celsius.

Note: This is independent of the units used for other purposes.

Decimal Places

The number of decimal places can be reduced for display purposes, for example, the engine temperature is measured to 0.1 °C but is better displayed with no decimal places.

Display Setup with Display Creator

When using Display Creator, communications and channels need to be set up. To automate this, a DBC file is created when the Dash Manager configuration is saved. This file can then be imported into Display Creator.

The Display Creator Channels and Display Creator Settings tabs are used to set the definitions for creation of the DBC file. This file is then imported into Display Creator to automate the communications and channels setup.

External Displays (Display Creator) with CAN

External displays created with Display Creator use CAN for messaging, the following CAN values must be set:

- The CAN bus
- The address format
- The base address, or select the default.

A warning will display if any of the CAN settings conflict with existing CAN configurations.

Display Creator Channels Tab

This tab is used to select the channels to include in the DBC file. The DBC file is created when the configuration is saved.

The DBC file is imported by Display Creator to automate the setup of communications and channels.

Note: Channels selected in the Display Creator Setting tab (see below) must also be selected in this list for them to be included in the DBC file.

Display Creator Settings Tab

This tab is used to define page display behaviour.

Note: The channels selected on this tab must also be included in the Display Creator Channels list (see above) for them to be included in the DBC file for import to Display Creator.

Number of Pages

Specifies the number of pages defined in the applicable Display Creator configuration.

Preserve Page

If ticked and the device is power cycled, the last page that was displayed for at least five second before the power cycle occurred will display.

If not ticked and the device is power cycled, the default page will display.

Page Channels

Specifies the channels used to set page up, down and reset values.

Page up is the next page in numeric sequence, default channel is *Display Page Up Button*.

Page down is the previous page in numeric sequence; default channel is *Display Page Down Button*.

Page reset returns the display to the default page; default channel is *Display Page Reset Button*.

Output Channels

This is used to select the output channel, which is the channel that controls the page displayed; default channel is *Display Page*.

Note: For page control to function, this channel should be included in the Display Creator Channels list so that it is included in the DBC file for import to Display Creator.

For example, if the output channel value is 3 (that is page 3 is displayed), it is increased to 4 via the *Display Page Up Button* channel and decreased to 2 via the *Display Page Down Button* channel.

Options Tab

This tab is used to select whether a DBC file should be generated, and if so, its filename.

If the DBC file is to be generated, specify a filename or select the default, The default syntax is: [name of the configuration]-[display name].dbc.

Alarms

Alarm Comparisons

The warning alarm limits are fully programmable and may include up to 6 comparisons to ensure that the alarms are only activated at the correct time. For example, an engine temperature alarm may activate at 95 °C if the ground speed has been above 50 km/h for 30 seconds. The speed comparison avoids the alarm showing during a pit stop due to heat soak. Additionally another comparison could be set at a higher temperature to cover all other situations.

The comparison values can be automatically incremented or (decremented) when an alarm occurs. For example the engine temperature alarm may be set at 95 °C with and increment of 5 °C, so that the second time the alarm activates at 100 °C. A limit may be set on the number of times the comparison value is allowed to increment. An alarm may return to its original value after a period of time, in case the alarm condition was temporary.

The alarms can be dependent on the current display mode page (Warm-up, Practice or Race).

Alarm Behaviour

Alarms are either:

- Active and unacknowledged (alarm conditions are true).
- Inactive and unacknowledged (alarm condition was true but became not true before alarm was acknowledged).
  These will continue to display until acknowledged.
- Active and acknowledged (alarm conditions are true but not displayed).
- Inactive (conditions needed to make an alarm active are not met or true).

The following behaviour applies:

- Active and inactive unacknowledged alarms remain displayed until they are acknowledged, either by the Acknowledge Button or automatically after a defined period of time. After acknowledgement, and if the alarm is still active, it may display again after the "do not display message interval" has elapsed.

  Note: If it appears that an active unacknowledged alarm cannot be acknowledged (that is, it continues to display), it could be that the "Do not display this message again until ... seconds have elapsed" is set to zero.

- If there is more than one unacknowledged alarm, the alarm with the highest priority (that is, the alarm that is highest on the alarm list) is displayed.
- If there are a number of unacknowledged alarms, these will display in priority sequence as each higher priority alarm is acknowledged.

Alarm Status Panel

Additionally an Alarm Status panel may be displayed which shows the current state of up to 6 active acknowledged alarms. The panel is off by default and may be turned on or off using the Alarm Acknowledge button when there are no alarm messages displayed. If displayed, it will be obscured while there is an unacknowledged alarm.

Below are four examples of the Alarm Status Panel.

Other Functions

The C187 can perform many other functions accessible from the Functions menu including the following:

- Shift Lights – to configure the shift point values for use with the Shift Lights.
- Shift Light Module – to configure the C187 16 stage shift lights as well as an additional MoTeC's SLM-C or SLM.
- Telemetry to set up telemetry channels
- *Tell-tales Setup* to store minimum or maximum values
- *Engine Log Setup* to set up four separate engine logs with separate conditions
- *Diagnostics Log Setup* to set up conditions and channels for the diagnostics log
- *Preserved Channels* to set up the conditions when to preserve channels

Refer to C187 Dash Manager online help for additional information.

Operation

To perform any of the activities in the *Online* menu, the PC needs to communicate to the C187.

Note: All other menu items perform offline activities.

Retrieving the Logged Data

- On the *Online* menu, click *Get Logged Data*

A personal computer is used to unload the logged data from the C187. The logged data is then stored on the computer hard disk.

After each unload the user has the option to clear the logging memory.

The unload may be interrupted part way through if necessary by disconnecting the computer. The partial unload will contain the most recently logged data and will be stored on the computer hard disk. In this case the C187 logging memory is not cleared and logging will continue as normal at the end of the existing data. Next time the logged data is unloaded both the new data and the previously partly unloaded data will be retrieved.

Sending and Retrieving Configuration Files

- On the *Online* menu, click *Send Configuration* to send the currently open configuration file

When a configuration file is sent to the C187 the existing C187 data is retrieved and stored in the *From Dash Backups* directory to use in case the data in the C187 needs to be restored. The maximum number of files is 10.

- On the *Online* menu, click *Get Configuration* to retrieve the current configuration file

This is normally not necessary unless the original file is not available on the PC.

Zeroing Sensors

Some sensors require regular zeroing, for example Steering Angle, Suspension Position, Ride Heights, G Force Sensors & Throttle Position. C187 Dash Manager provides a feature for easy zeroing of all these sensors.

Checking Operation

Monitor Channels

- On the *Online* menu, click *Monitor Channels*
- To show any channel on an oscilloscope style screen, click *Utilities* and then *Oscilloscope*

The currently active channels can be monitored to check the operation of all functions and measurements.

Simulate

- On the *Online* menu, click *Simulate*

The Simulate feature allows most input channels to be manually changed so that the C187 operation can be checked under abnormal conditions, e.g. High Engine Temp. This is extremely useful for checking that the C187 is working as expected.

Test

- On the *Online* menu click the appropriate test

A number of tests are provided to check the operation of the C187, such as the *Display Test*.

Configuration Versions and Updating

- On the *Online* menu, click *Upgrade Dash Version*

The software inside the C187 (firmware) can be updated by the user at any time to take advantage of the latest features.

Matching Versions

The firmware version must match the version of the C187 Dash Manager software on the PC in order to communicate. C187 Dash Manager will show a warning if the versions do not match.

Tip:
To check the version of C187 Dash Manager, click *About MoTeC C187 Dash Manager* on the *Help* menu.
The firmware version is displayed on the bottom line of the display for 2 seconds when the C187 is powering up.

Matching Configuration File

The configuration file must also match the software and firmware versions used. The display will show a warning if the file does not match.

Configuration files can be updated by choosing the option to automatically update the configuration file while updating the software (firmware). It can also be done manually by upgrading the configuration file and sending it to C187:

- On the *File* menu, click *Open*
- In the *Files of type* box select the new version file extension.
  The file will be converted to the new version format and saved with the same file name but with the new version file extension.
  Note: The old file is not changed.
- On the *Online* menu, click *Send Configuration* to send the configuration file to the C187

Upgrading C187

- On the *Online* menu, click *Enable Dash Options*

Several options are available as upgrades to customise and grow your system.

The currently enabled options can be listed and new options can be activated through a password acquired from MoTeC.

Password Protection

- On the *Online* menu, click *Set Access Passwords*

Several C187 capabilities can be protected from unauthorised access by using the password protection.

Other Online Activities

Many other activities are accessible from the *Online* menu including the following:

- *Set Reference Lap* to send a reference lap to the C187 used in the lap gain/loss system. See *Calculations*.
- *View* to view:
  - configuration settings e.g. *Tell-tales, Engine Log*
  - *GPS Beacon Definitions*
  - saved details e.g. *Running Totals*
  - *Device Halt Counts*
- *Retrieve* to retrieve *Tell-tales* and *Engine Log*
- *Communication* to list the current *Connections Settings*
- *Miscellaneous*

- *Erase Logged Data without unloading*
- *Serial Number* to view the Serial and Hardware Number.
  The Serial Number is required when ordering upgrade passwords.
  The Hardware Number is for **MoTeC** internal use.
- *Change Display Mode* to switch between Race, Warm-up and Race mode

Refer to C187 Dash Manager online help for additional information.

Appendices

Specifications

Specifications listed as optional are available as upgrades to customise and grow your system. These additional features are activated through a simple password acquired from MoTeC, at any time when you need it. An overview of the upgrades can be found in *C187 Upgrades*.

Logging

- 250 MB standard logging memory (500 MB optional)
- Logging rates up to 1000 samples per second
- Fast Ethernet download

Display

- Type: 7” colour TFT LCD, anti-reflective
- Resolution: 800 x 480, anti-aliased graphics
- Layouts: diverse selection of configurable fixed layouts, or purchase Display Creator to create user designed and configured layouts
- 48 user-defined, scrollable message lines with programmable overrides
- 3 programmable modes with customisable labels

Inputs

- 10 (20 with I/O upgrade*) analogue voltage inputs:
  - 4 (8*) x 0 to 5.46 V, 1.33 mV resolution
  - 6 (12*) x 0 to 15.0 V, 3.66 mV resolution
- 4 (8 with I/O upgrade) analogue temperature inputs
  - 0 to 15 V, 3.66 mV resolution
- 4 x Digital inputs
- 4 x Speed inputs with voltage measuring capability
- 2 x Switched inputs
- Compatible with VIM/SVIM input expanders

Outputs

- 6 x low side outputs PWM, digital or switched outputs
- 1.0 Amp max, current limited and thermal overload protected
- Compatible with up to 2 E888/E816 input/output expanders

Expanders

- Compatible with up to two E888/E816 input/output expanders (providing full functional use), VIM, SVIM

Internal Sensors

- 3-axis accelerometer, detection range: +/- 5G
- Dash temperature sensor
- Sensor supply voltage
- Battery voltage

Communications

- 4 configurable CAN buses, with individually programmable CAN bus speeds. One can be used as RS232 Receive. Only 2 of the CAN buses support VIM/SVIM Expanders
  - Maximum data range 1 Mbit/sec
  - Recommended terminating impedance 100 ohm
- 2 dedicated RS232 ports
- 1 LIN port

Power Supply

- Operating voltage: 6 to 32 V DC
- Operating current: 0.8 ampere typical (at full brightness, excluding sensor currents)
- Reverse Battery protection
- Battery Transient protection

Operating Temperature

- Internal Temperature Range: –20 to 80 °C (above 60 °C maximum backlight brightness progressively reduced)
- Ambient Temperature Range: –20 to 60 °C

Sensor Supply Current

- 5 V Sensor supply: 0.25 ampere maximum
- 8 V Sensor supply: 0.25 ampere maximum

Ingress Protection (IP) Rating

- IP 68 - Dust tight, protected against water immersion (continuous submersion to depth of at least 1 m)

Note: IP rating is dependent upon the user ensuring that connector wire entries are waterproof, which as a minimum, requires all unused wire cavities on the connector to be plugged

Physical

- Size: 196.2 x 122.5 x 24.9 mm excluding connector
- Weight 670 g
- 1 x 79 pin Autosport connector

C187 Upgrades

Several options are available as upgrades to customise and grow your system. These additional features are activated through a password acquired from MoTeC, at any time when you need it.

For the C187 Dash Logger the following upgrades are available:

Data Logging (part 29918)

Increases the internal logging memory to 500 MB. (Standard 250 MB memory available)

Pro Analysis (part 29920)

Provides access to advanced i2 Pro data analysis software with multiple graph overlays, X-Y plots, advanced maths functions, synchronised video (automatic alignment), and flexible layouts to accommodate virtually any user preference.

T2 Telemetry (part 29923)

Enables transmission of live data from the vehicle to the pit where it can be viewed in real time using the MoTeC Telemetry Monitor software. Requires radio modems or other means of transmission.

The upgrade allows use of the older Telemetry Monitor or T2 Telemetry.

Remote Logging

Enables conversion of telemetry data into a log file to use with i2 analysis software. Requires the Telemetry upgrade.

I/O (part 29900)

Provides additional input/output functionality consisting of:

- 10 extra analogue voltage inputs (AV11 to AV20, see pinout)
- 4 extra analogue temperature inputs (AT5 to AT8, see pinout)

Advanced Functions (part 29905)

- Advanced Functions, which provides:
  - Advanced Maths
  - Channel Maths
  - 16 x 2D Tables (instead of 4)
  - 16 x 3D Tables (instead of 4)
  - 50 User Conditions (instead of 20)

C127 Display Creator (part 29916)

Allows the user to create fully configurable custom layouts.

Characteristics

Input Characteristics

Analogue Voltage Inputs

Suitable for:	Potentiometers Voltage output sensors Variable resistance sensors with pull-up resistor
Measure Voltage Range:	Inputs 1—4 and 11—14: 0 to 5.46 V All other Inputs: 0 to 15.0 V **Note**: Voltages outside this range may affect the readings on other inputs.
Input Resistance:	100k ohms to 0 V
Resolution:	Inputs 1—4 and 11—14: 1.33 mV All other Inputs: 3.66 mV
Measurement Methods:	Ratiometric Absolute Variable Resistance Off/On
Update Rate:	1000 times/second
Filter:	240 Hz 1st order
Calibration Accuracy:	Gain 0.05% max (Ratiometric method) Gain 0.15% max (Absolute method) Offset $\pm$ 6 mV max Linearity $\pm$ 6 mV max Temperature Stability 60 ppm/°C max Calibration Schedule 12 months

Analogue Temp Inputs

Suitable for:	2 wire variable resistance sensors some voltage output sensors
Measure Voltage Range:	0 to 15.0 V **Note**: Voltages outside this range may affect the readings on other inputs.
Input Resistance:	1000 ohms pull-up to 5 V sensor supply +100 k to 0 V
Resolution:	3.66 mV
Measurement Methods:	Ratiometric Absolute Variable Resistance Off/On
Update Rate:	1000 times / second
Filter:	290 Hz 1st order
Calibration Accuracy:	Gain: 0.05% max (Ratiometric method) Gain: 0.15% max (Absolute method) Offset: ± 6 mV max Linearity: ± 6 mV max Temperature Stability: 60 ppm/°C max Calibration Schedule: 12 months

Switch Inputs

Suitable for:	Switch to 0 V Off/On Voltage signal
Pull-up Resistor:	2200 ohms to 3.3 V
Voltage Range:	0 to 15 V
Positive Trigger Threshold:	2.4 V max
Negative Threshold:	0.6 V min
Hysteresis:	0.4 V Min
Measurement Methods:	Off/On only
Filter Time Constant:	22 usec

Digital Inputs

Suitable for:	Switch to 0 V Logic signal and open collector device (e.g. Hall Switch)
Pull-up Resistor:	2200 ohms to 3.3 V
Voltage Range:	0 to 15 V
Positive Trigger Threshold:	2.4 V max
Negative Threshold:	0.6 V min
Hyst eresis:	0.4 V min
Update Rate:	100 times / second
Filter Time Constant:	22 usec
Measurement Methods:	**Frequency** Resolution 0.1 Hz Maximum Frequency 3200 Hz Rising Edge Triggered **Period 1 usec** Measures period between rising edges Resolution 1 usec Maximum 32 msec **Period 100 usec** Measures period between rising edges Resolution 100 usec Maximum 3.2 sec **Pulse Width 1 usec** Measures pulse low time Resolution 1 usec Maximum 32 msec **Pulse Width 100 usec** Measures pulse low time Resolution 100 usec Maximum 3.2 sec

Speed Inputs

Hall mode	A 2200 ohm pull-up resistor connected to 2.7 V.
Suitable for:	Switch to 0 V Logic signal Open collector device (e.g. Hall Switch)
Pull-up Resistor	2200 ohms to 2.7 V
Voltage Range	0 to 15V
Trigger Threshold	Selectable between -1.33 V and 4.68 V
Magnetic mode	The pull-up resistor is disengaged and the trigger levels can be varied depending on the input frequency.
Suitable for:	Two wire magnetic sensor (variable reluctance sensor)
Input Resistance	100k ohms to ground (no pull-up)
Voltage Range	-80 V to +80 V
Programmable trigger levels	-1.33 V to 4.68 V
For both modes	
Update Rate:	100 times / second
Filter Time Constant	25 usec
Hysteresis	0.17 V min
Measurement Methods:	**Frequency** Resolution 0.1 Hz Maximum Frequency 3200 Hz Falling Edge Triggered **Period 1 usec** Measures period between falling edges Resolution 1 usec Maximum 32 msec

	Period 100 usec Measures period between falling edges Resolution 100 usec Maximum 3.2 sec **Pulse Width 1 usec** Measures pulse high time Resolution 1 usec Maximum 32 msec **Pulse Width 100 usec** Measures pulse high time Resolution 100 usec Maximum 3.2 sec

Analogue Input Sampling

4 times oversampling is scheduled with samples taken every 250 usec, providing measurements every 1 msec.
The following inputs are sampled at 250 usec, with microsecond offsets as shown in the table:

Offsets	0.0 usec	+1.5 usec	+3.1 usec
0.0 usec	AT1	AV1	AV15
+9.3 usec	AT2	AV2	AV16
+20.9 usec	AT3	AV3	AV17
+30.1 usec	AT4	AV4	AV18
+39.4 usec	AT5	AV5	AV19
+51.0 usec	AT6	AV6	AV20
+60.3 usec	AT7	AV7	AV21
+71.9 usec	AT8	AV8	AV22
+81.1 usec	N/A	AV9	AV23
+90.4 usec	8VSEN	AV10	AV24
+102.0 usec	5VSEN	AV11	INT TEMP
+111.3 usec	ACCELX	AV12	SPD1
+122.9 usec	ACCELY	AV13	SPD2
+132.1 usec	ACCELZ	AV14	SPD3
+141.4 usec	N/A	BAT VOLTS	SPD4

Output Characteristics

Output Type:	Open Collector (Drives to ground) with weak pull-up (10 kΩ) to battery positive
Current:	1.0 A max, current limited & thermal overload protected
Output Clamp:	40 V Flyback Clamp (no clamp diode to supply).

Pin List by Pin Number

Pin	Name	Function
1	AV15	Analogue Voltage Input 15 (with 44 I/O upgrade)
2	AV16	Analogue Voltage Input 16 (with 44 I/O upgrade)
3	AV17	Analogue Voltage Input 17 (with 44 I/O upgrade)
4	AV18	Analogue Voltage Input 18 (with 44 I/O upgrade)
5	AV19	Analogue Voltage Input 19 (with 44 I/O upgrade)
6	0V	Sensor 0 V
7	BAT-	Battery Negative
8	BAT+	Battery Positive
9	AUX1	Auxiliary Output 1
10	AUX2	Auxiliary Output 2
11	AUX3	Auxiliary Output 3
12	AUX4	Auxiliary Output 4
13	AUX5	Auxiliary Output 5
14	AUX6 / LIN	Auxiliary Output 6 / LIN
15	RS232-2 TX	RS232-2 Transmit Output
16	RS232-2 RX	RS232-2 Receive Input
17	0V	Sensor 0 V
18	5V	Sensor 5 V
19	AV7	Analogue Voltage Input 7
20	AV8	Analogue Voltage Input 8
21	AV9	Analogue Voltage Input 9
22	AV10	Analogue Voltage Input 10
23	AV11	Analogue Voltage Input 11 (with 44 I/O upgrade)
24	AV12	Analogue Voltage Input 12 (with 44 I/O upgrade)
25	AV13	Analogue Voltage Input 13 (with 44 I/O upgrade)

Pin	Name	Function
26	AV14	Analogue Voltage Input 14 (with 44 I/O upgrade)
27	0V	Sensor 0 V
28	5V	Sensor 5 V
29		Reserved
30		Reserved
31		Reserved
32		Reserved
33	0V	Sensor 0 V
34	AT1	Analogue Temp Input 1
35	AT2	Analogue Temp Input 2
36	AT3	Analogue Temp Input 3
37	AT4	Analogue Temp Input 4
38	AT5	Analogue Temp Input 5 (with 44 I/O upgrade)
39	AT6	Analogue Temp Input 6 (with 44 I/O upgrade)
40	0V	Sensor 0 V
41	AT7	Analogue Temp Input 7 (with 44 I/O upgrade)
42	AT8	Analogue Temp Input 8 (with 44 I/O upgrade)
43	0V	Sensor 0 V
44	5V	Sensor 5 V
45	AV1	Analogue Voltage Input 1
46	AV2	Analogue Voltage Input 2
47	AV3	Analogue Voltage Input 3
48	AV4	Analogue Voltage Input 4
49	AV5	Analogue Voltage Input 5
50	AV6	Analogue Voltage Input 6
51	0V	Sensor 0 V
52	DIG1	Digital Input 1

Pin	Name	Function
53	DIG2	Digital Input 2
54	DIG3	Digital Input 3
55	DIG4	Digital Input 4
56	0V	Sensor 0 V
57	SW1	Switch Input 1
58	SW2	Switch Input 2
59	CAN4L	CAN 4 Low
60	CAN4H	CAN 4 High
61	0V	Sensor 0 V
62	8V	Sensor 8 V
63	SPD1	Speed Input 1
64	SPD2	Speed Input 2
65	SPD3	Speed Input 3
66	SPD4	Speed Input 4
67	E-TX+	Ethernet Transmit +
68	E-TX–	Ethernet Transmit –
69	AV20	Analogue Voltage Input 20 (with 44 I/O upgrade)
70	RS232-1 TX	RS232 Transmit Output
71	CAN3L	CAN 3 Low
72	CAN3H	CAN 3 High
73	CAN1L	CAN 1 Low
74	CAN1H	CAN 1 High
75	CAN2L	CAN 2 Low / RS232 Ground Input
76	CAN2H	CAN 2 High / RS232 Receive Input
77	E-RX+	Ethernet Receive +
78	E-RX–	Ethernet Receive –
79	RS232-1 RX	RS232 Receive Input

Pin List by Function

Pin	Name	Function
Battery Power		
7	BAT-	Battery Negative
8	BAT+	Battery Positive
Analogue Voltage Inputs		
45	AV1	Analogue Voltage Input 1
46	AV2	Analogue Voltage Input 2
47	AV3	Analogue Voltage Input 3
48	AV4	Analogue Voltage Input 4
49	AV5	Analogue Voltage Input 5
50	AV6	Analogue Voltage Input 6
19	AV7	Analogue Voltage Input 7
20	AV8	Analogue Voltage Input 8
21	AV9	Analogue Voltage Input 9
22	AV10	Analogue Voltage Input 10
23	AV11	Analogue Voltage Input 11 (with 44 I/O upgrade)
24	AV12	Analogue Voltage Input 12 (with 44 I/O upgrade)
25	AV13	Analogue Voltage Input 13 (with 44 I/O upgrade)
26	AV14	Analogue Voltage Input 14 (with 44 I/O upgrade)
1	AV15	Analogue Voltage Input 15 (with 44 I/O upgrade)
2	AV16	Analogue Voltage Input 16 (with 44 I/O upgrade)
3	AV17	Analogue Voltage Input 17 (with 44 I/O upgrade)
4	AV18	Analogue Voltage Input 18 (with 44 I/O upgrade)
5	AV19	Analogue Voltage Input 19 (with 44 I/O upgrade)
69	AV20	Analogue Voltage Input 20 (with 44 I/O upgrade)

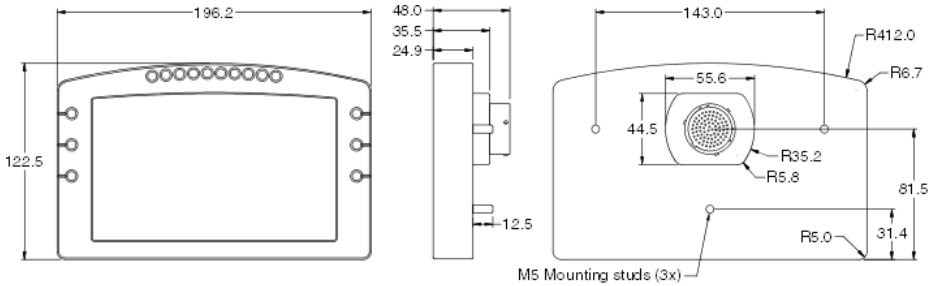
Pin	Name	Function
Analogue Temp Inputs		
34	AT1	Analogue Temp Input 1
35	AT2	Analogue Temp Input 2
36	AT3	Analogue Temp Input 3
37	AT4	Analogue Temp Input 4
38	AT5	Analogue Temp Input 5 (with 44 I/O upgrade)
39	AT6	Analogue Temp Input 6 (with 44 I/O upgrade)
41	AT7	Analogue Temp Input 7 (with 44 I/O upgrade)
42	AT8	Analogue Temp Input 8 (with 44 I/O upgrade)
Switch Inputs		
57	SW1	Switch Input 1
58	SW2	Switch Input 2
Digital Inputs		
52	DIG1	Digital Input 1
53	DIG2	Digital Input 2
54	DIG3	Digital Input 3
55	DIG4	Digital Input 4
Speed Inputs		
63	SPD1	Speed Input 1
64	SPD2	Speed Input 2
65	SPD3	Speed Input 3
66	SPD4	Speed Input 4
Auxiliary Outputs		
9	AUX1	Auxiliary Output 1

Pin	Name	Function
10	AUX2	Auxiliary Output 2
11	AUX3	Auxiliary Output 3
12	AUX4	Auxiliary Output 4
13	AUX5	Auxiliary Output 5
14	AUX6 / LIN	Auxiliary Output 6 / LIN
8 V Sensor		
62	8V	Sensor 8 V
5 V Sensor		
18	5V	Sensor 5 V
28	5V	Sensor 5 V
44	5V	Sensor 5 V
0 V Sensor		
6	0V	Sensor 0 V
17	0V	Sensor 0 V
27	0V	Sensor 0 V
33	0V	Sensor 0 V
40	0V	Sensor 0 V
43	0V	Sensor 0 V
51	0V	Sensor 0 V
56	0V	Sensor 0 V
61	0V	Sensor 0 V
CAN Interface		
73	CAN1L	CAN 1 Low
74	CAN1H	CAN 1 High
75	CAN2L	CAN 2 Low / RS232 Ground Input

Pin	Name	Function
76	CAN2H	CAN 2 High / RS232 Receive Input
71	CAN3L	CAN 3 Low
72	CAN3H	CAN 3 High
59	CAN4L	CAN 4 Low
60	CAN4H	CAN 4 High
Ethernet		
68	E-TX-	Ethernet Transmit -
67	E-TX+	Ethernet Transmit +
78	E-RX-	Ethernet Receive -
77	E-RX+	Ethernet Receive +
RS232		
70	RS232-1 TX	RS232 Transmit Output
79	RS232-1 RX	RS232 Receive Input
15	RS232-2 TX	RS232-2 Transmit Output
16	RS232-2 RX	RS232-2 Receive Input
Reserved		
29		
30		
31		
32		

Mounting Dimensions

C187



Note:

- All dimensions in [mm]
- Ensure product is not stressed when mounted
- Dimensions indicate actual product size, allow for clearance when mounting

Wiring

Connector

C187 connector	79 pin Autosport connector
Mating connector	#68086

Wire Specification

Wire

Wire to suit C187 connector: 22# Tefzel, Mil Spec : M22759/16-22

M22759/16 Wire Ratings (for various wire gauges)

Insulation Material: Tefzel
Conductor: Tin Plated Copper
Voltage Rating: 600 V
Maximum Temperature: 150 °C

Wire Gauge [AWG]	*Cross Sectional Area [mm2]*	*Max Current at 100 °C Ambient [A]*	*Resistance [ohm / m])*	*Resistance [ohm / 1000 ft]*
22	0.38	5	0.045	14
20	0.61	6	0.028	8.5
18	0.96	9	0.018	5.5
16	1.2	12	0.014	4.3
14	1.9	18	0.009	2.7
12	3.0	24	0.006	1.8

Crimp Tool

Crimp Tool: M22520/2-01
Positioner for Crimp Tool: M22520/2-07
Crimp Contacts are type 22D (needed to set the crimp tool correctly)

Wire Stripping Tool

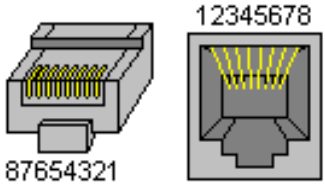
Recommended: Ideal Industries 45-2133 stripping tool with LB1195 wire stop

PC Connection

Ethernet Wiring Schematic:

ADL3 / C185 / C187		Ethernet Connector pin	
Pin	**Function**	**Pin**	**Function**
77	Ethernet RX +	1	Ethernet TX +
78	Ethernet RX –	2	Ethernet TX –
67	Ethernet TX +	3	Ethernet RX +
68	Ethernet TX –	6	Ethernet RX –

Pin numbering



Wire

CAT5 UTP Ethernet cable

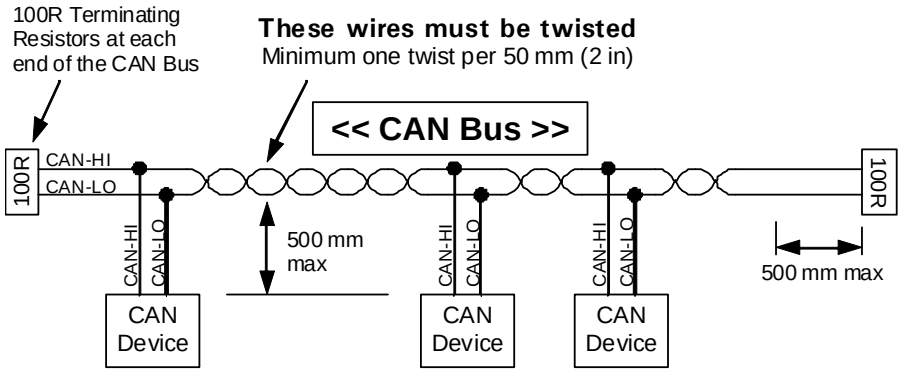
Cable

An Ethernet RJ45 socket, connecting to a standard Ethernet cable, is provided on:

- #62207 C185 loom incorporating (this loom is used on both the C185 and C187)
- #61131 Ethernet cable, unterminated, 2 meter
- #61132 Ethernet to Autosport pins cable, 1.8 m

CAN Bus Wiring Requirements

- The CAN bus should consist of a twisted pair trunk with 100R (0.25 watt) terminating resistors at each end.
  - If the CAN bus is less than 2 meter (7 ft) long, a single termination resistor may be used.
- The preferred cable for the trunk is 100R data cable.
- The maximum length of the bus is 16 meter (50 ft)
- CAN devices (such as MoTeC Dash Loggers, ECUs etc) may be connected to the trunk with up to 500 mm (20 in) of twisted wire.

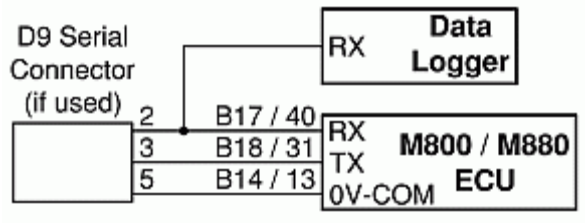


C187 to ECU wiring (RS232)

The following details the methods for connecting the C187 to the various MoTeC ECUs via RS232. In all cases this is done using the serial data stream generated by the Telemetry function of each ECU.

In the case of the M800, M880 and M4e the C187 may be directly wired to the ECU because these ECUs use RS232 interface levels. On the M48, M4 (pre M4e) and the M8, a Computer Interface Module (CIM) or a PCI cable is required to convert the signals to RS232.

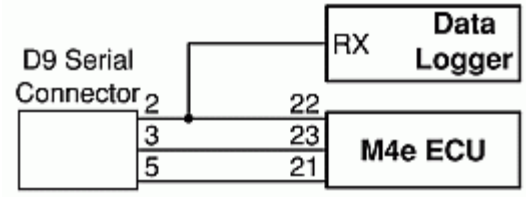
M800 / M880



Note:

- The data to the C187 will be interrupted while a PC is connected (DOS software only)
- The 9 pin connector is not used if using the Windows Calibration software.
- Data may be sent to the C187 via the CAN bus as an alternative to the serial connection.

M4e



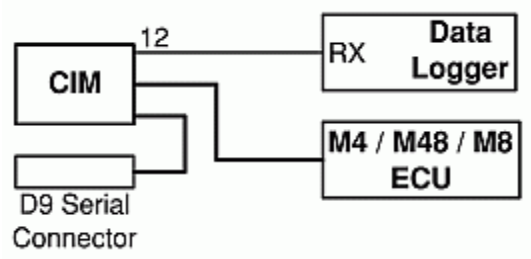
Note:

- Older M4 ECUs require a different connection method
- The data to the C187 will be interrupted while a PC is connected.

M48, M4 (pre M4e) and M8

The M48 & M8 and M4 (pre M4e) require the use of a CIM module or a PCI Cable to convert the logic level signals used by these ECUs into RS232 levels.

Using a CIM Module



Refer to the CIM module drawing for full wiring details.

Note: The data to the C187 will be interrupted while a PC is connected.

Update Rate Summary

Device	Input Type	Maximum Update Rate (per second)
C185/C187	Analogue Voltage Inputs	1000
C185/C187	Analogue Temperature Inputs	1000
C185/C187	Digital Inputs and Speed Inputs	100
C185/C187	RS232 and CAN Communications	50 max *
C185/C187	CAN comms fast receive	1000
ACL	RS232 Communications	200 *
ACL	General CAN communications	200 *
VIM	AV Fast Inputs	5000
VIM	AV Differential Voltage Inputs	1000
VIM	AV High Resolution Inputs	500
VIM	AV Special Inputs	2000
VIM	Speed Inputs	100
ADL2/SDL	Analogue Voltage Inputs 1 to 4 (ADL2/SDL) and 11 to 14 (ADL2)	1000
ADL2/SDL	Other Analogue Voltage Inputs	500
ADL2/SDL	Analogue Temperature Inputs	500
ADL2/SDL	Lambda Inputs	100
ADL2/SDL	Digital & Speed Inputs	100
SDL	Internal G Sensors	100
E888	Thermocouple Inputs (First Device / Second Device)	100 / 50
E888/816	Analogue Voltage & Digital Inputs (First Device / Second Device)	200 / 50

* RS232 & General CAN Communications update rate depends on how frequently the data is sent from the device. Typically the update rate from an M4, M48, M8 or M800 ECU is about 20 times per second using RS232 and about 50 times per second for the M800 using CAN.

Command line

Usage:

dash.exe -c[connection] -d -x -l -e -t -s [config file name]

[config file name]
(Optional)
Fully qualified path to the configuration file.
(eg "c:\motec\dash\config\bathurst.d30")
Note: the path must included the file extension (eg .d30)

Options :

Each of the following options can be given as "/[character]" or "-[character]". They are shown here as "-[character]".

-c[Connection Name]
(Optional)
Select a preconfigured connection by name as configured in the dash connections dialog.
(eg -c"Primary CAN Connection").
Note: There must not be a space between the c and the connection name.

-d
(Optional)
Causes the debug console to be displayed.
Only available for debug builds.

-x
(Optional)
Causes the app to terminate when one the following tasks has been performed.

Tasks :

One or more of the following may be specified.

-l

(Optional)

Perform a “Get Logged Data” operation.

-e

(Optional)

Perform a “Get Engine Log” operation.

-t

(Optional)

Perform a “Get Tell-tale Values” operation.

-p

(Optional)

Perform a “Print Summary” operation.

Note: The configuration file must be specified using a fully qualified path including the file extension.

(e.g. -p "c:\motec\dash\config\bathurst.d30")

Note: There must be a space between -p and configuration file name.

-s

(Optional)

Perform a “Send Configuration” operation.

Note: The configuration file must be specified using a fully qualified path including the file extension.

(e.g. -s "c:\motec\dash\config\bathurst.d30")

Note: There must be a space between -s and configuration file name.

-u

(Optional)

Perform an “Upgrade Dash Version” operation.

CAN Bus Bandwidth Limit

The total available CAN bandwidth available on a single CAN bus is 1 Mbit/sec.

The bandwidth used by the total of all devices on a particular CAN bus must not exceed approximately 90% of this value (900000 bits/second)

If the total bandwidth required exceeds this specification then some devices should be connected to the second CAN bus.

Note: C187 Dash Manager will warn if the bandwidth is likely to be exceeded.

VIM

Approximate Bandwidth = Total Measurement Rate (samples/sec) x 30 (bits per sample)

Note: The Measurement Rate for each input is equal to the logging rate for that input or 50 Hz, whichever is higher.

Example Calculation

4 channels at 2000 Hz

20 channels at 500 Hz

40 channels at 20 Hz (Occupies 50 Hz)

Calculation:

Total Measurement Rate = 4 x 2000 + 20 x 500 + 40 x 50 = 20000 (samples/sec)

Approximate Bandwidth = 20000 x 30 = 600000 (bits/sec)

E888/E816

Device on first CAN Address

Bandwidth = 145000 (bits/sec)

Device on second CAN Address

Bandwidth = 55000 (bits/sec)

Other Devices

BR2, SLM , PLM	Negligible
SDL, ADL2, MDD, M800 ECU	TBD

Comms Error Codes

The "Comms CAN x Diagnostic" and "Comms RS232 Diagnostic" channels seen can be used to diagnose communications problems.

Multiple errors are shown by error codes added together. For example: A RS232 error of 9 = parity + overrun.

The error values have the following definitions:

RS232 Errors

Errors generated by RS232 communications.

1	PARITY	Parity bit incorrect. The comms parity setup is wrong, or there is electrical interference causing errors in the data.
2	FRAMING	Not seeing the stop bit. The baud rate or stop bit setup is wrong or there is electrical interference causing errors in the data.
4	NOISE	Glitch in the data. Electrical interference is causing glitches in the signal. (C187 does not generate this error)
8	OVERRUN	A byte was received before the previous byte was read indicating that the processor was too busy to read the message.
512	NO DATA	A valid message header was not found - either there is a wiring fault or comms is setup incorrectly.
1024	CHECKSUM	A valid message header was found, but the checksum was wrong. If seen in combination with other errors there is electrical noise. If only checksum errors occur there may be a software incompatibility between the C187 and the other device.
2048	WRONG DATA	Could not decode the protocol.

General CAN Errors

Errors generated by general CAN communications.

2	FRAMING	Only generated when used with an E888/E816 expander. Inconsistent message length.
8	OVERRUN	Receive or transmit overrun error. In the receive case a byte was received before the previous byte was read indicating that the processor is too busy to read the message. In the transmit case the transmit buffer is full which could happen if the CAN bus is too busy.
256	BAD CONFIG	The device configuration is not valid (eg overlapping CAN addresses)
512	NO DATA	A valid message header was not found - either there is a wiring fault or comms is setup incorrectly, (problem could be at either end). E.g.: transmit and receive CAN IDs do not match.
1024	CHECKSUM	Only generated when used with an Async Expander. See RS232 errors
2048	WRONG DATA	Only generated when used with an Async Expander or E888/E816 Expander. Async Expander: Could not decode the protocol. E888/E816: Compound ID incorrect.
4096	BUS WARNING	More than 96 errors have occurred on the CAN bus. Check wiring and termination resistors. The CAN bus may still be operational.
8192	BUS OFF	More than 255 errors have occurred on the CAN bus. CAN communications is suspended when this error occurs. Check wiring, termination resistors and the CAN baud rate. Also check that CAN HI and CAN LO are correct (not swapped).
16384	CAN TRANSMIT	CAN bus transmit warning

"VIMCOM" Errors

Errors generated by "VIMCOM" devices (VIM, ADL2, SDL).

Note: VIM COM devices are connected via CAN.

C187 Errors

These errors are generated by the C187 communications system.

2	FRAMING	Incorrect number of samples received.
256	BAD CONFIG	Configuration mismatch between C187 and device. Resend the configuration.
512	NO DATA	VIMCOM packets have not been found. Either there is a wiring fault or C187 Connections is setup incorrectly.
2048	WRONG DATA	VIMCOM packet has bad length.
4096	BUS WARNING	More than 96 errors have occurred on the CAN bus. Check wiring and termination resistors. The CAN bus may still be operational.
8192	BUS OFF	More than 255 errors have occurred on the CAN bus. CAN communications is suspended when this error occurs. Check wiring, termination resistors and the CAN baud rate. Also check that CAN HI and CAN LO are correct (not swapped).

VIMCOM Device Errors.

These error codes are sent once by the VIMCOM device on resuming data transmission and therefore indicate why data was previously not being transmitted.

4097	STARTUP	Device has restarted (normally due to power up) Data is not sent until sync is achieved.
4098	HALT	Data not sent due to deliberate halt. For example configuration or firmware being sent.
4099	OVERRUN	Data not sent due to transmit buffer overrun (possibly due to CAN bus too busy)

4100	SYNC TIMEOUT	Data not sent due to C187 sync message timeout (sync not received from C187)
4101	CAN ERROR	Data not sent due to error on CAN bus
4102	SYNC EXCEEDED	Data not sent due to excessive sync error (synchronisation too far out)

PC Connection - IP Address

Basic Direct Connection (Automatic IP Address)

The simplest way to connect the C187 to a PC is directly to an Ethernet port on the PC and using the default network settings (automatically obtain an IP address)

This method can take up to 60 seconds to connect on Windows XP. On Windows Vista it takes approximately 8 seconds. This delay will occur every time the Ethernet cable is connected to the C187 or the C187 is power cycled.

The advantage of this method is that the PC can be connected to a network when it is not connected to the C187 without having to change any settings on the PC (assuming the network is configured to obtain an IP address automatically)

When the C187 is connected to the PC, a network connection icon will appear in the Windows taskbar tray. To check that connection is in progress, place the cursor over this icon. It will show “Acquiring Network Address”. Once the connection is established the message will show "Limited or No Connectivity". This is normal when using this method and means that Windows has automatically assigned an IP Address to the PC.

To check if the PC is configured to obtain an IP address automatically:

1. Click *Start* | *Settings* | *Control Panel*
2. Double click on *Network Connections*
3. Double click on the connection that is to be used to connect to the C187, usually this is called *Local Area Connection*
4. Click *Properties*
5. Select *Internet Protocol (TCP/IP)* from the list
6. Click *Properties*
7. Ensure that *Obtain an IP address automatically* is selected

Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Fast Direct Connection (Fixed IP Address)

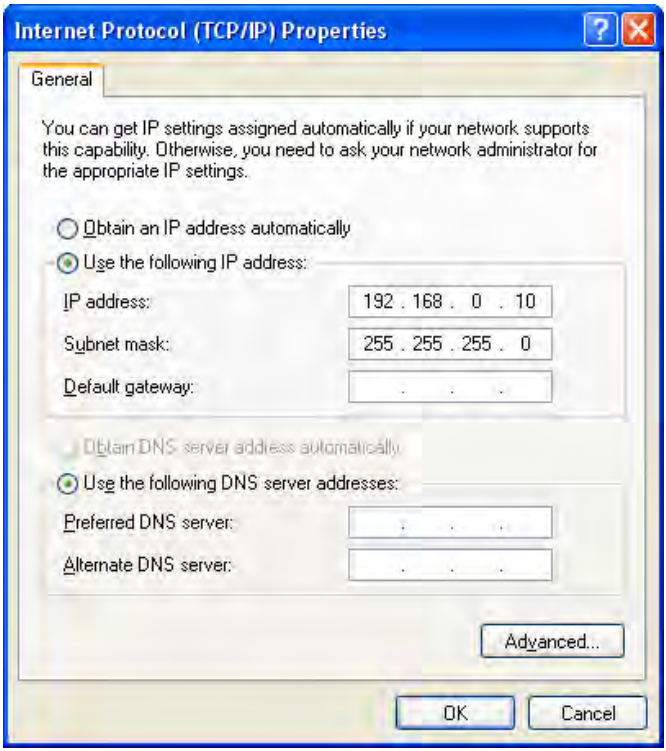
If the Basic Direct Connection method takes too long to connect, a more advanced setup can be used to reduce connection times to around 3 seconds.

Notes:

- Please be aware that changing the PC's network settings can make connections to other devices on the network stop working.
- Only change the PC network settings if the PC does not need to be connected to a network or to a device such as a cable or ADSL modem via the same Ethernet port.
- If the PC has a second Ethernet port that is not used to connect to a network then this can be used without affecting the network.
- On some PCs an unused Ethernet port may be available if the PC always connects to the network via a wireless connection.

To configure the PC with a fixed IP address:

1. Click *Start* | *Settings* | *Control Panel*
2. Double click on *Network Connections*
3. Double click on the connection that is used to connect to the C187, usually *Local Area Connection*
4. Click *Properties*
5. Select *Internet Protocol (TCP/IP)* from the list
6. Click *Properties*
7. Select *Use the following IP address*
8. Enter the IP address and Subnet mask shown below.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 0 . 10
Subnet mask: 255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Network Connection

The C187 can also be connected to a network rather than directly to a single PC. This allows any PC on the network to communicate with the C187.

The connection time to the C187 will be less than 3 seconds (if the C187 is already powered and running)

Note: The PC network settings should not be changed.

Network Switches and Cables

The C187 must be connected to the network via a network switch.

All MoTeC's PC connection cables (see PC Connection) are Ethernet crossover cables, that allow direct connection to a PC and are compatible with network switches that support auto cable sensing (sometimes called “Auto-MDI/MDI-X” or “Universal Cable Recognition”)

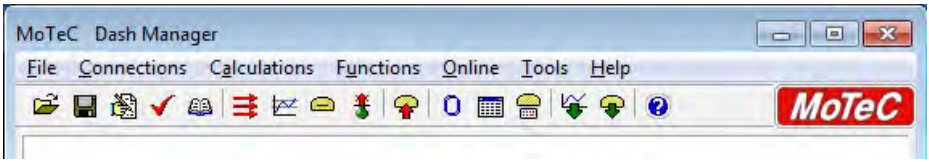
If the network switch does not support crossover cables ***MoTeC*** recommends upgrading the network switch rather than having two types of cables, which may cause confusion.

Windows Keyboard Shortcuts

When using a laptop in and around a car, it is often not practical to use a mouse to navigate through the program.

Using the keyboard to select options is easier.

Main Menu



To access the main menu, press ALT + the key for the underlined letter in the menu, followed by the underlined letter of the item in the drop down menu. E.g. ALT + F, N for File New.

Alternatively press and release ALT, select the desired menu item using the arrow keys, press ENTER to activate it.

Closing a Window

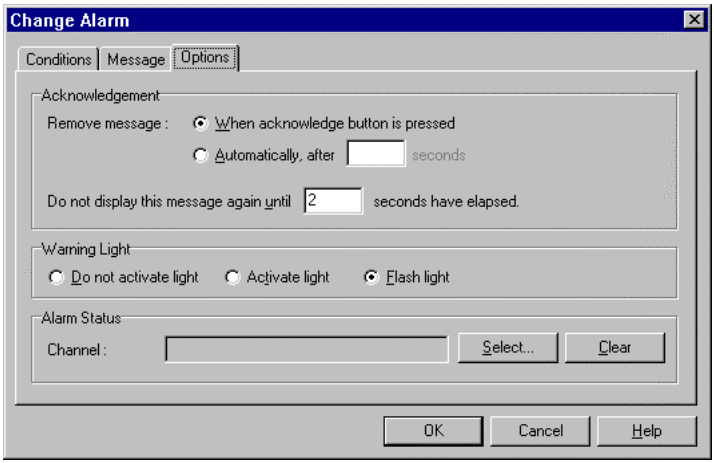
Press ENTER for OK or Close (only when the OK or Close button has a bold line around it)

Press ESC to Cancel or Close

Getting Help

- Press F1 to get help on the current window or item
- Press ALT + H if the screen has a Help button
- Select Help from the Main Menu to access the main help system.

Selecting an Item in a Window



To access the various items in a window, press ALT + the key for the underlined letter of the item of interest, e.g. to select the 'Flash Light' item press ALT + F

Alternatively use the TAB key to move through the dialog box (use SHIFT + TAB to move backwards). The selected control is usually indicated by a dotted line around it, or by highlighting the text or item selected within the control.

Using the Selected Item

The method of using the selected item (or control) depends on the type of control. The common controls are detailed below:

Command Button

Command buttons are generally used to show another screen or perform a particular function.

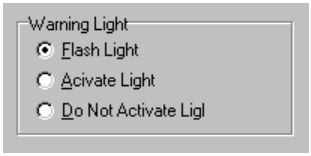
Press ALT + the key for the underlined letter (S), or use the TAB key to navigate to the command button. To select, press ENTER or SPACEBAR.

Check Box

A check box is used to tick on or off a particular option.

Press ALT + the key for the underlined letter (F), or use the TAB key to navigate to the Check Box. To select, press SPACEBAR.

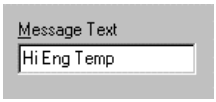
Group Box



The Group box is used to select an item from a group of options.

Press ALT + the key for the underlined letter (F, A or D), or use the TAB key to navigate to the Group box. To select, use the arrow keys.

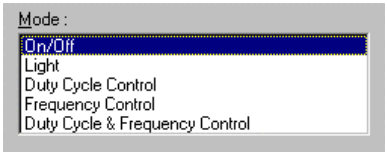
Text Box



A text box is used to enter a value or text.

Press ALT + the key for the underlined letter (M) or use the TAB key to navigate to the Text box, type in the new value or text. Use the BACKSPACE or DELETE to remove unwanted characters.

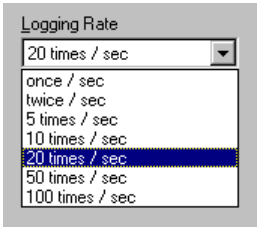
List Box



A list is used to select from a number of options.

Press ALT + the key for the underlined letter (M) or use the TAB key to navigate to the List Box. To select, use the arrow keys.

Drop-down List Box



A Drop-down list box is used to select from a number of items, but only the selected item is shown until a new item needs to be selected.

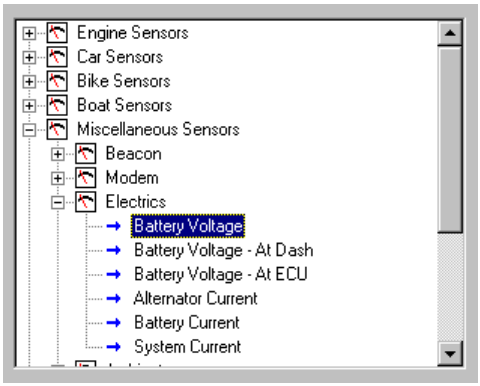
Press ALT + the key for the underlined letter (L) or use the TAB key to navigate to the Drop down List Box. To select the desired item, use the arrow keys, and press ENTER to close the list.

Tabs

Tabs are used to select the different tab pages of a screen.

To select the next tab, press CTRL + TAB. To select the previous tab, press CTRL + SHIFT +TAB.

Tree Structure



A Tree Structure is used to select items from a hierarchical list

The UP ARROW key moves the cursor up (selects the item above)

The DOWN ARROW key moves the cursor down (selects the item below)

The RIGHT ARROW key expands; expandable branches indicated by a plus sign (+)

The LEFT ARROW key collapses; collapsible branches indicated by a minus sign (-)

Screen Cleaning

Gently wipe using a clean water dampened microfibre cloth, followed by a clean dry microfibre cloth.

Glossary

MoTeC Devices	
ACL	Advanced Central Logger
ADL2	Advanced Display Logger - second generation
ADL3	Advanced Display Logger - third generation
BR2	Beacon Receiver
BTX	Beacon Transmitter
CIM	Computer Interface Module
CLS	Central Logging System
C125	Colour Display Logger
C127	7” Colour Display Logger
C185	Colour Display Logger
C187	7” Colour Display Logger
CDL3	Club Display Logger
DBW4	Drive By Wire expander
E816	Input/Output Expander
E888	Input/Output Expander
i2	MoTeC data analysis software
i2 Pro	MoTeC data analysis software, professional version
IEX	Ignition Expander
LTC	Lambda to CAN module
LTCD	Lambda to CAN Dual module
M2R	ECU dedicated to run 2 rotor engines
M4	ECU for engines with up to 4 cylinders or up to 2 rotors
M400	ECU for modern engines with up to 4 cylinders or up to 2 rotors
M48	ECU for engines with up to 8 cylinders and 2 rotors
M600	ECU for modern engines with up to 6 cylinders or up to 3 rotors
M800	ECU for modern engines with up to 12 cylinders or up to 4 rotors
M800 Plug-In	ECU for direct replacement of a factory ECU

M880	ECU for modern engines with up to 12 cylinders or up to 4 rotors
MDC	Mitsubishi Diff Controller
MDD	Mini Digital Display
MLS	ECU dedicated to run Chevrolet LS1 and Lexus/Toyota V8s
PCI Cable	PC Interface cable
PDM15	Power Distribution Module with 15 outputs
PDM16	Power Distribution Module with 16 outputs
PDM30	Power Distribution Module with 30 outputs
PDM32	Power Distribution Module with 32 outputs
PLM	Professional Lambda Meter
RTC	Real Time Clock
SDC	Subaru Diff Controller
SDL	Sport Display Logger
SDL3	Sport Display Logger – second generation
SGA	Strain Gauge Amplifier
SLM	Shift Light Module
SLM-C	Shift Light Module – Club version
SUU	Software Update Unit
TCM	Traction Control Module
VIM	Versatile Input Module
Other	
Calibration	The process of converting an electrical value into a physical value, e.g. volts into kilometres per hour
CAN	Controller Area Network - communication protocol
CDI	Capacitive Discharge Ignition
ECU	Engine Control Unit
GPS	Global Position System
MAF	Mass Air Flow
MAP	Manifold Absolute Pressure
PID	Proportional, Integral and Derivative gain
PWM	Pulse Width Modulated

RPM	Revolutions Per Minute
RS232	Recommended Standard 232, communication protocol
RX	Receive
TDC	Top Dead Centre
TX	Transmit